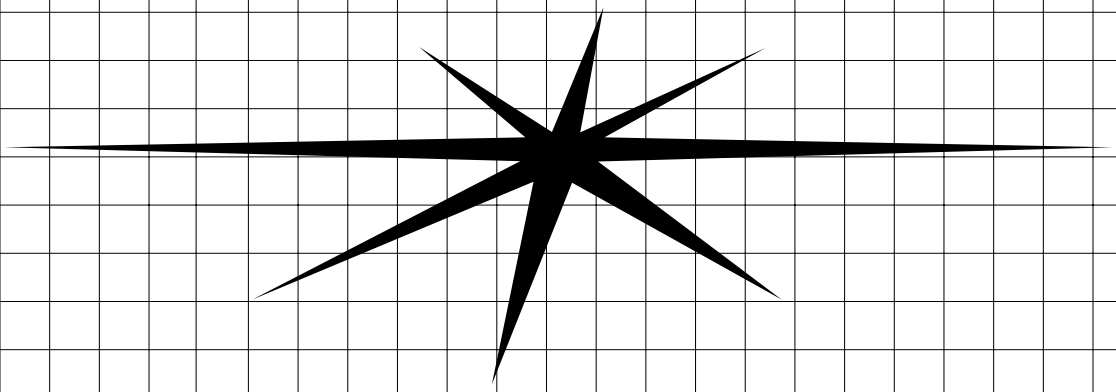
THERMAL DYNAMICS

STAK PAK® II



CONTROL MODULE

Model 6032

Service Manual

May 30, 1996

Manual No. 0-2428

WARNING Read and understand this entire Service Manual and your employer's safety practices before installing, operating, or servicing the equipment.

WARNING While the information contained in this Service Manual represents our best judgement, Thermal Dynamics Corporation assumes no liability for its use.

STAK PAK® II Control Module Service Manual Number 0-2428

Published by:
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SECTION 1: GENERAL INFORMATION

1.01 Notes, Cautions And Warnings

Throughout this manual, notes, cautions, and warnings are used to highlight important information. These highlights are categorized as follows:

NOTE

An operation, procedure, or background information which requires additional emphasis or is helpful in efficient operation of the system.

CAUTION

A procedure which, if not properly followed, may cause damage to the equipment.

WARNING

A procedure which, if not properly followed, may cause injury to the operator or others in the operating area.

1.02 Important Safety Precautions

WARNING

Operation and maintenance of plasma arc equipment involves potential hazards. All operators and personnel should be alerted to possible hazards and precautions should be taken to prevent possible injury.

GASES AND FUMES

Gases and fumes produced during the plasma cutting process can be dangerous and hazardous to your health.

- Ventilation must be adequate to remove gases and fumes during operation. Threshold limit values and how to measure the amounts to assure adequate ventilation are found in publication (A), page 2.
- Vapors of chlorinated solvents can form the toxic gas phosgene when exposed to ultraviolet radiation from an electric arc. Solvents, degreasers, and potential sources of these vapors must be removed from the cutting area.
- Keep all fumes and gases from the breathing area.
- Use a downdraft cutting table or water table to capture fumes and gases.
- Use an air-supplied respirator if ventilation is not adequate to remove all fumes and gases.
- Oil or grease in the presence of oxygen may ignite and burn violently. Keep cylinders, valves, couplings, regulators, hoses, and other apparatus clean and free from oil and grease. Oxygen cylinders and apparatus should not be handled with oily hands or gloves. Do not allow an oxygen stream to contact oily or greasy surfaces.
- Do not use oxygen as a substitute for compressed air.

ARC RAYS

Arc rays can injure eyes and burn skin.

- Use a welding shield with proper filter. A #4 filter or darker is recommended for drag cutting. A #10 filter or darker is recommended when cutting with a standoff.
- Wear proper protective clothing.
- Make sure others in the operating area are protected from arc rays.

ELECTRIC SHOCK

Electric shock can kill.

- Install and maintain equipment according to USA Standard C1, National Electric Code.
- Proper grounding procedures must be adhered to when using plasma arc cutting equipment. The workpiece must be grounded to a solid electrical ground.
- Do not contact electrically live parts. Do not touch torch parts when input power is present in the power supply.
- Insulate yourself and others from the workpiece and ground.
- Replace any cracked or damaged insulating parts including torches, hoses, and leads.

- Disconnect power source before disassembling the torch. Turn off primary power before working on torch parts, including changing cups and tips.
- The shield cup must be installed prior to operating the torch.
- When operating plasma arc cutting equipment in a damp or wet area, extra care should be taken.
- Use this equipment for plasma cutting and gouging only. It is not designed for any other cutting or welding process.
- Use only the torches specified in this instruction manual.

FIRE

FIRE can be caused by hot slag and sparks.

- Remove combustibles from working area or provide a fire watch.
- Do not cut containers that have held combustibles. Remove all flammable and combustible materials in the operating area that may be ignited by sparks.
- Do not mount this equipment over combustible surfaces.

NOISE

Noise can cause permanent hearing loss..

- Wear proper protective ear muffs or plugs.
- Make sure others in the operating area are protected from noise.

COMPRESSED GAS CYLINDERS

- Compressed gas cylinders are potentially dangerous.
- Refer to suppliers for proper handling procedures.

1.03 Publications

The following publications provide additional information on safety precautions:

(A) Bulletin No. C5.2-83 “Recommended Safe Practices for Plasma Arc Cutting”

(B) American National Standard ANSI Z49.1-1983 “Safety in Welding and Cutting”

Both publications are available from:

American Welding Society Inc.
2501 Northwest 7th Street
Miami, Florida 33125
Telephone (305) 443-9353

(C) OSHA Safety and Health Standards, 29CFR1910 available from:

The U.S. Department of Labor
Washington, D.C. 20210

(D) CSA Standard W117.2 “Safety in Welding, Cutting, and Allied Processes” obtainable from:

The Canadian Standards Association
178 Rexdale Blvd.
Toronto, Ontario M9W1R3, Canada

WARNING

Read and understand this instruction manual and your employer’s safety practices.

1.04 PRÉCAUTIONS

AVERTISSEMENT

La mise en oeuvre et l'entretien de tout équipement plasma implique des dangers potentiels. Le personnel doit etre mis en garde contre les risques suivants et toutes les précautions doivent etre prises pour eviter de prendre des risques pour la santé.

Les gaz et les fumees

Les gaz et les fumees peuvent etre dangereux et constituer un risque pour votre sante.

- La ventilation doit être suffisante pour évacuer les fumées lors de la coupe. (Dans la publication (A), page 4, vous trouverez la façon de mesurer les quantités permettant d'affirmer que la ventilation est adéquate, ainsi que les valeurs limites à ne pas dépasser.)
- Les vapeurs de solvants chlorés peuvent former un gaz toxique, le Phosgène, lorsqu'elles sont exposées aux radiations ultraviolettes émises par l'arc électrique. Tous les solvants, dégraissants et sources potentielles de ces vapeurs doivent être enlevés de l'aire de coupe.
- Evacuer toutes les fumées et les gaz de l'aire de respiration.
- Utiliser un établi de coupe à tirage vers le bas pour attirer les fumées et les gaz.
- Utiliser un masque aves arrivée d'air si la ventilation n'est pas suffisante pour éliminer tous les gaz et fumées.
- De l'huile ou de la graisse en contact avec l'oxygène peuvent s'enflammer et brûler avec violence. Nettoyez tous cylindres, valves, connecteurs, régulateurs, boyaux et autres appareils afin d'éviter toute trace d'huile ou de graisse.
- Ne jamais manipuler les cylindres ou l'équipement à oxygène avec des mains ou des gants graisseux.
- Evitez que l'oxygène entre en contact avec des surfaces huileuses ou graisseuses.
- Ne pas utiliser l'oxygène pour remplacer l'asair compressé.

Les rayons de l'arc

LES RAYONS DE L'ARC peuvent abimer les yeux et bruler la peau.

- Utiliser un écran de soudage muni d'un filtre numéro 4 ou plus sombre en coupant "au contact" ou numéro 10 ou plus sombre en coupant à distance.
- Porter des vêtements protecteurs adéquats.
- Assurez vous que les autres personnes ne soient pas atteintes par les rayons.

Decharge electrique

Une DECHARGE ELECTRIQUE peut tuer.

- Faire l'installation et l'entretien de l'appariel selon les normes du Code Electrique des Etats-Unis (Norme NEC-USA Standard C1), ou celles en vigueur dans votre pays.
- Il faut appliquer les procédures de mise à la terre spécifiques à l'utilisation de dispositifs de coupe au plasma. La pièce ou le métal sur lequel une personne coupe doit être reliée à une bonne prise de terre.
- Ne pas toucher à des pièces sous tension.
- Isolez-vous du courant de coupe et de la terre.
- Remplacer toute pièce isolante fendue ou endommagée, y compris le corps de torche et les câbles.
- Couper l'alimentation avant la depose du chalumeau. Couper l'alimentation avant d'intervenir sur la torche, y compris pour changer la buse ou l'électrode.
- Avant d'utilisere le chalumeau s'assurer que l'ecran de protection est en place.
- Soyez particulièrement vigilant lorsque vous coupez avec un appariel de coupe au plasma dans un endroit humide.

Un encendie

Les Etincelles et les scories peuvent provoquer UN ENCENDIE.

- Oter tout combustible de l'aire de coupe ou installer un détecteur de flammes.

- Ne pas couper de récipient ayant contenu des combustibles. Tout matériel inflammable ou combustible pouvant être allumé par une étincelle doit être enlevé de l'aire de coupe.

LE BRUIT

Le bruit peut causer la surdité.

- Proté des protecteurs auditifs.
- Assuré que tous les autres sont protégé du bruit.

Bouteilles de gaz comprimes

LES RÉSERVOIRS DE GAZ SONT DANGEREUX.

Se référer aux directives du constructeur pour une bonne utilisation.

1.05 Les publications

LES PUBLICATIONS suivantes contiennent des renseignements supplémentaires sur les précautions à prendre pour garantir la sécurité.

(A) Bulletin No. C5.2-83 “Recommended Safe Practices for Plasma Arc Cutting”

(B) American National Standard ANSI Z49.1-1983 “Safety in Welding and Cutting”

Vous pouvez vous les procurer toutes les deux auprès de:

American Welding Society Inc.
2501 Northwest 7th Street
Miami, Florida 33125 U.S.A.
Téléphone (305) 443-9353

(C) OSHA Safety and Health Standards 29CFR 1910, disponible auprès du:

U.S. Department of Labor
Washington DC 20210, USA

(D) Norme de l'ACNOR W117-2, “Safety in Welding, Cutting, and Allied Processes” que l'on peut obtenir auprès de:

L'Association Canadienne Des Normes
178 Rexdale Blvd
Toronto, Ontario, Canada, M9W 1R3

AVERTISSEMENT

Lire et comprendre ce manuel d'instructions, ainsi que les pratiques sur la securite emises par votre employeur.

1.06 Declaration Of Conformity

Manufacturer: Thermal Dynamics Corporation
Address: Industrial Park #2
West Lebanon, New Hampshire 03784
USA

Description of equipment: Plasma Cutting Equipment: Namely, Pak2XT, Pak Master 25, Pak Master 50, Pak Master 100, Stak Pak, Signature 625XR, Signature 1250XR, PAK 15XC, Pak44, Pak 45, TA 500, TA 1000 and associated accessories.

Plasma Welding Equipment: Namely, WC100B, HE150, Weld Sequencer, PS3000 and associated accessories.

* Serial numbers are unique with each individual piece of equipment and details description, parts used to manufacture a unit and date of manufacture.

*The equipment conforms to all applicable aspects and regulations of the 'Low Voltage Directive' (Directive 73/23/EU, as recently changed in Directive93/63EU) and to the National legislation for the enforcement of this Directive.

National Standard and Technical Specifications.

The product is designed and manufactured to a number of standards and technical requirements among them are:

* CSA (Canadian Standards Association) standard C22.2 number 60-M1990 for Arc welding equipment.

* UL (Underwriters Laboratory) rating 94VO flammability testing for all printed-circuit boards used.

* IEC 974-1 (BS 638-PT10) (EN 60 974-1) applicable to welding equipment anassociated accessories.

* Extensive product design verification is conducted at the manufacturing facility as part of the routine design and manufacturing process, to ensure the product is safe and performs as specified. Rigorous testing is incorporated into the manufacturing process to ensure the manufactured product meets or exceeds all design specifications.

Thermal Dynamics has been manufacturing products that perform in a safe manner for more than 30 years and will continue to achieve excellence in our area of manufacture.

Manufacturers responsible representative: David Ashworth
Vice President & Managing Director
Thermadyne Europe
Chorley England.

1.07 Statement Of Warranty

LIMITED WARRANTY: Thermal Dynamics Corporation (hereinafter "Thermal") warrants that its products will be free of defects in workmanship or material. Should any failure to conform to this warranty appear within the time period applicable to the Thermal products as stated below, Thermal shall, upon notification thereof and substantiation that the product has been stored, installed, operated, and maintained in accordance with Thermal's specifications, instructions, recommen dations and recognized standard industry practice, and not subject to misuse, repair, neglect, alteration, or accident, correct such defects by suitable repair or replacement, at Thermal's sole option, of any components or parts of the product determined by Thermal to be defective.

THIS WARRANTY IS EXCLUSIVE AND IS IN LIEU OF ANY WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.

LIMITATION OF LIABILITY: Thermal shall not under any circumstances be liable for special or consequential damages, such as, but not limited to, damage or loss of purchased or replacement goods, or claims of customers of distributor (hereinafter "Purchaser") for service interruption. The remedies of the Purchaser set forth herein are exclusive and the liability of Thermal with respect to any contract, or anything done in connection therewith such as the performance or breach thereof, or from the manufacture, sale, delivery, resale, or use of any goods covered by or furnished by Thermal whether arising out of contract, negligence, strict tort, or under any warranty, or otherwise, shall not, except as expressly provided herein, exceed the price of the goods upon which such liability is based.

THIS WARRANTY BECOMES INVALID IF REPLACEMENT PARTS OR ACCESSORIES ARE USED WHICH MAY IMPAIR THE SAFETY OR PERFORMANCE OF ANY THERMAL PRODUCT.

THIS WARRANTY IS INVALID IF THE PRODUCT IS SOLD BY NON-AUTHORIZED PERSONS.

The limited warranty periods for Thermal products shall be as follows (with the exception of STAK PAK II): A maximum of three (3) years from date of sale to an authorized distributor and a maximum of two (2) years from date of sale by such distributor to the Purchaser, and with the following further limitations on such two (2) year period. The limited warranty period for STAK PAK II shall be as follows: A maximum of four (4) years from date of sale to an authorized distributor and a maximum of three (3) years from date of sale by such distributor to the Purchaser, and with the following further limitations on such three (3) year period:

PAK UNITS, POWER SUPPLIES	STAK PAK II	PARTS All OTHERS	LABOR
MAIN POWER MAGNETICS	3 YEARS	2 YEARS	1 YEAR
ORIGINAL MAIN POWER RECTIFIER	3 YEARS	2 YEARS	1 YEAR
CONTROL PC BOARD	3 YEARS	2 YEARS	1 YEAR
ALL OTHER CIRCUITS AND COMPONENTS INCLUDING, BUT NOT LIMITED TO, STARTING CIRCUIT, CONTACTORS, RELAYS, SOLENOIDS, PUMPS, POWER SWITCHING SEMI-CONDUCTORS	1 YEAR	1 YEAR	1 YEAR
CONSOLES, CONTROL EQUIPMENT, HEAT EXCHANGES, AND ACCESSORY EQUIPMENT	1 YEAR	1 YEAR	1 YEAR
TORCH AND LEADS	180 DAYS	180 DAYS	180 DAYS
REPAIR/REPLACEMENT PARTS	90 DAYS	90 DAYS	NONE

Warranty repairs or replacement claims under this limited warranty must be submitted by an authorized Thermal Arc® repair facility within thirty (30) days of the repair. Authorized Thermal Arc® repair facilities are authorized distributors and authorized Thermal Arc® Service Centers. No transportation costs of any kind will be paid under this warranty. Transportation charges to send products to an authorized warranty repair facility shall be the responsibility of the customer. All returned goods shall be at the customer's risk and expense. This warranty supersedes all previous Thermal warranties.

Thermal Arc® is a Registered Trademark of Thermal Dynamics.

Effective February 1, 1995

SECTION 2: INTRODUCTION

2.01 Scope Of Manual

This Manual provides Service Instructions for Thermal Dynamics STAK PAK® Control Module Model 6032.

Refer to Operating Manual (0-2463) for individual operating procedures. Information in this edition is therefore particularly applicable to the Troubleshooting and Repair of the equipment, and is intended for use by properly-trained Service Technicians familiar with this equipment.

Read this Manual and the Operating Manual, 0-2463, thoroughly. A complete understanding of the capabilities and functions of the equipment will assure obtaining the performance for which it was designed.

2.02 General Service Philosophy

Several key points are essential to properly support the application and operation of this equipment.

A. Application

The equipment should satisfy the customer's requirements as supplied and as described in Section 3 of this manual. Be sure to confirm that the equipment is capable of the application desired.

B. Modifications

No physical or electrical modifications other than selection of standard options and Accessories are to be made to this equipment.

C. Customer/Operator Responsibilities

It is the customer / operators' responsibility to maintain the equipment and peripheral Accessories provided by Thermal Dynamics in good operating order in accordance with the procedures outlined in the Operating Manual, and to protect the equipment from accidental or malicious damage.

D. Repair Restrictions

The electronics consists of Printed Circuit Board Assemblies which must be carefully handled, and must be replaced as units. No replacement of printed circuit solder-mounted components is allowed except as noted in this manual.

If to be returned, the replaced Printed Circuit Board Assemblies must be properly packaged in protective material and returned intact per normal procedures.

2.03 Service Responsibilities

The Service Technician should be familiar with the equipment and its capabilities. He should be prepared to recommend arrangements of components which will provide the most efficient layout, utilizing the equipment to its best possible advantage.

Maintenance work should be accomplished in a timely manner. If problems are encountered, or the equipment does not function as specified, contact Technical Services Department at West Lebanon for assistance.

SECTION 3: DESCRIPTION

3.01 Introduction

The information in this Section has two purposes: To fimilarize the Service Technician with the capabilities and limitations of the equipment, and to provide him with an overall understanding which will allow him, in turn, to properly train the customer's operating personnel.

3.02 General Description

STAK PAK® Control Module contains all operator controls, electrical and gas inputs and outputs, pilot circuitry, and the torch leads receptacle. A spare parts compartment is built into the top enclosure.

The Control Module must have at least one Power Module connected to it for it to operate. Each power module provides 1/2 inch cut capacity. Up to four can be easily stacked under each control module to provide up to 2 inch cutting capability with the appropriate torch.

A Base Plate provides a secure mounting surface and protects the power and logic signal receptacles on the bottom module.

Options and accessories are available as required.

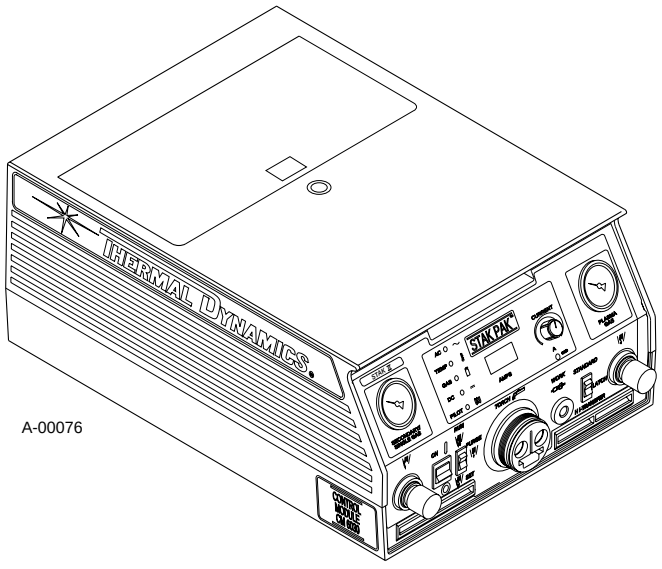


Figure 2-1 STAK PAK® Control Module

3.03 Technical Specifications

A. Controls

ON / OFF Switch

Output Current Control

RUN / PURGE / SET Switch

STANDARD / LATCH / HI-TRANSFER Switch

Secondary / Single-Gas Regulator

Plasma Gas Regulator

Corner Slowdown Adjustment

B. Control Indicators

AC , TEMP, GAS, DC, and PILOT LED's

Secondary / Single-Gas and Plasma Pressure Gauges

Digital Ammeter with Output Preview

Corner Slowdown Preview and Display

PIP Circuit Status Display

C. Input Power

200 to 460 VAC (±10%)

50 or 60 Hz, Single or Three-Phase

Amps depends on input voltage, phase & number Power Modules used (Refer to Appendix VII)

D. Output Power

Potentiometer

Minimum Output 14 amps

Maximum 35 amps per Power Module

Total of 140 Amps with Four Power Modules

E. Pilot Circuitry

CD, Constant DC

F. Pilot Modes

Auto-Restart, Pre-Flow Delay, Recycle

G. CNC Signals

Start / Stop, OK-to-Move, Corner Slowdown, Full CNC Available with Remote

H. Dimensions

9.1" (0.23 m) High x 16" (0.41 m) Wide x 22" (0.56 m) Long

9. Weight

37.5 lbs (17 kg)

SECTION 4: SERVICE TROUBLESHOOTING DIAGNOSTICS

4.01 Introduction

This Section provides service diagnostics for the STAK PAK® Control Module Assembly (CM6032), allowing the Technician to islolate any faulty Subassemblies. Refer to Section 5, Repairs & Replacement Procedures, for parts replacement instructions.

Under no circumstances are field repairs to be attempted on Printed Circuit Boards or other Subassemblies of this unit. Evidence of unauthorized repairs will void the factory warranty.

NOTE

The troubleshooting contained in this manual is for the Control Module CM 6032 only. Troubleshooting other parts of the system is covered in the seperate manuals for that product.

4.02 Periodic Inspection & Procedures

This subsection describes inspection procedures which should be performed at periodic intervals as required.

A. Physical Inspection

Check that all cable connections are secure.

B. Cleaning

Unit should be cleaned as described in Operating Manual 0-2463.

4.03 Troubleshooting Guide

A. Troubleshooting and Repair

Troubleshooting and repairing the this unit is a process which should be undertaken only by those familiar with high voltage high power electronic equipment.

WARNING

There are extremely dangerous voltage and power levels present inside this unit. Do not attempt to diagnose or repair unless you have had training in power electronics measurement and troubleshooting techniques.

B. Advanced Troubleshooting

NOTE

For basic troubleshooting and parts replacement procedures refer to STAK PAK® Control and Power Components Operating Manual 0-2463.

The advanced troubleshooting covered in this Servive Manual requires control module disassembly and live measurements. It is helpful for solving many of the common problems that can arise with the Stak Pak® Plasma Cutting System.

If major complex subassemblies are faulty, the unit must be returned to an authorized service center for repair.

Follow all instructions as listed and complete each in the order presented.

Specific test procedures and LED status identification tables have been grouped together, and are referenced by the troubleshooting guide.

The guide has seven sections as follows:

Section 4.04 - Circuit Fault Isolation

Section 4.05 - Main Input Power Problems

Section 4.06 - Internal Power Problems

Section 4.07 - Purge Problems

Section 4.08 - Pilot Arc Problems

Section 4.09 - Main Arc Problems

Section 4.10 - Test Procedures

C. How to use this Guide

The following information is a guide to help the Service Technician determine the most likely causes for various symptoms. This guide is set up in the following manner:

1. Perform operational check(s) on the equipment to isolate problem to possible circuit(s).

2. Determine symptom and isolate to defective assembly using the following format:

   X. Symptom (Bold Type)

   Any Special Instructions (Text Type)

   1. Cause (Italic Type)

   a. Check / Remedy (Text Type)

3. Locate your **symptom** in the appropriate Sub-Section.

4. **C**heck the *causes* (easiest listed first) for the **symptom**.

5. Check the remedies listed for each cause.

6. Repair as needed being sure to verify that unit is fully operational after any repairs.

NOTE

Many signals are transfered between Printed Circiut Board Assemblies on Ribbon Cables. If these cables become faulty they can then cause various problems. ***Do not*** *forget about these cables when troubleshooting.*

4.04 Circuit Fault Isolation

NOTE

Before beginning troubleshooting visually inspect the internal components for signs of over heating, fractures and damage.

This section is to help isolate the defect circuit before troubleshooting, identify symptoms, and test the unit for proper operation. Follow the instructions as given to identify the possible symptom(s) and the defective circuit. After repairs are complete then run the following tests again to verify that the unit is fully operational.

A. Initial Setup Conditions

Set the Control Module switches as follows:

ON / OFF to OFF

RUN / PURGE / SET to SET

STANDARD / LATCH / HI-TRANSFER to STANDARD

Set the CURRENT control potentiometer to maximum.

B. Main Input Power Test

Connect the main AC power to the unit and note the following:

- AC indicators on the back of each power module should be ON
- Fans should not be operating
- Front panel LED's should be OFF

This completes the Main Input Power Test. If the above are all correct then proceed to paragraph 'C'.

If the above does not function as noted then note the symptom and proceed to Section 4.05, Main Input Power Problems.

C. Internal Power Test

Set the Control Module ON / OFF switch to ON and note the following:

- AC indicator ON
- TEMP indicator ON (green)
- GAS indicator ON
- Both plasma and secondary gas flow, except when used with the PCH / M-35 where only the secondary / single gas will flow
- Fan will operate
- DC and PILOT lndicators are OFF
- Display indicates current as set by CURRENT control
- Display indicates preview - Right most decimal point is ON.

This completes the Internal Power Test. If the above are all correct then proceed to paragraph 'D'.

If the above does not function as noted then note the symptom and proceed to Section 4.06, Internal Power Problems.

D. Purge Test

Set the Control Module ON / OFF switch to OFF

Set the RUN / PURGE / SET switch to RUN position

Set the Control Module ON / OFF switch to ON and note the following:

- GAS indicator ON
- Fan operates
- Gas flows and stops 10 - 40 seconds (depending on post-flow setting) after power on
- GAS indicator goes OFF
- Fan stops

This completes the Purge Test. If the above are all correct then proceed to paragraph 'E'.

If the above does not function as noted then note the symptom and proceed to Section 4.07, Purge Problems.

E. Pilot Arc Test

Press the torch switch and note the following:

- Both gases flow (secondary / single only for the PCH / M-35)
- GAS indicator turns ON
- Control Module fan operates
- After preflow delay DC and PILOT indicators turn ON
- Top Power Module DC indicator ON and fans operate

This completes the Pilot Arc Test. If the above are all correct then proceed to paragraph 'F'.

If the above does not function as noted then note the symptom and proceed to Section 4.08, Pilot Arc Problems.

F. Main Arc Test

Bring the torch to within 1/8"-3/8" of the work piece to establish a pilot arc, and note the following:

- Main cutting arc initiates and the pilot arc turns OFF
- PILOT indicator turns OFF
- Digital display indicates maximum as set by CURRENT control
- Right most decimal point turns OFF

This completes the Main Arc Test. If the above are all correct then the equipment should be operating properly. If problems still persist then contact Technical Services.

If the above does not function as noted then note the symptom and proceed to Section 4.09, Main Arc Problems.

4.05 Main Input Power Problems

Locate your symptom below:

A. AC indicator on rear panel of power module(s) is not on

1. *Main power disconnect not closed.*
   a. Close main power disconnect.
2. *Main power line fuses blown.*
   a. Replace Fuses.
3. *Defective input power cable.*
   a. Replace input power cable.

B. Main power line fuses blow as soon as main disconnect is closed.

1. *Power Module input shorted.*
   a. Refer to Section 4.10- E-1, Input Bridge Check.
2. *Input power cable installed incorrectly.*
   a. Refer to Operating Manual 0-2463, Section 3.05 and connect input cable.
3. *Single phase jumper wire installed incorrectly.*
   a. Refer to Operating Manual 0-2463, Section 3.05 and install jumper wire.

4.06 Internal Power Problems

Locate your symptom below:

A. All front panel indicators on Control Module are off. Control Module fan does not operate

1. *Improper input power line connections inside Control Module*
   a. Refer to Operating Manual 0-2463, Section 3.05 and correct if needed
2. *Fuse blown inside Control Module*
   a. Replace Fuse (1 FU)
3. *Auxiliary transformer primary plug connected incorrectly*
   a. Refer to Operating Manual 0-2463, Section 3.06 and correct as needed

If unit still does not operate, measure output voltages at J7 on the transformer for the following:

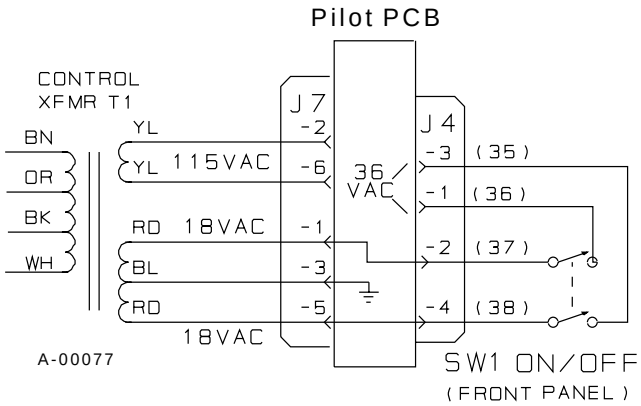
Pins	Voltage Level
2 to 6	115vac
1 to 5	36vac
1 to 3	18vac

   b. Replace transformer if incorrect

4. *Faulty ON/OFF switch*

Measure for 36vac on the Pilot PCB between J4-1 to J4-3.

   a. If voltage is not present replace the ON / OFF switch



B. AC indicator ON, TEMP indicator ON (red), System will not pilot

1. Air flow through unit is restricted.

a. Provide adequate air flow (Refer to Operating Manual 0-2463, Section 3.02)

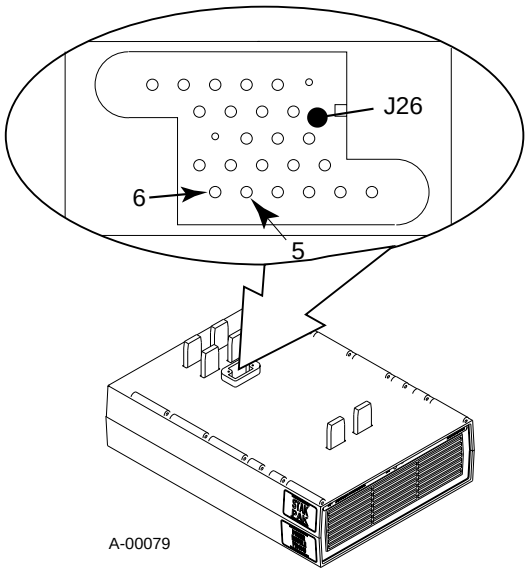
2. Defective Power Module

Disconnect ribbon cable from Logic PCB at J19. At the ribbon cable connector check for normally open condition from pin 26 to 27.

If shorted, then disconnect (unstack) all Power Module(s) and let unit cool.

Check each Power Module for normally open thermal switch at J26 pin 5 to 6

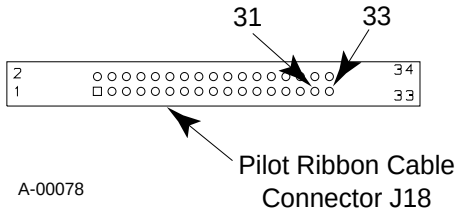
a. Replace Power Module if shorted.



3. Defective Pilot PCB or Pilot Ribbon Cable

Disconnect Pilot Ribbon Cable from Logic PCB at J18.

At the ribbon cable connector check for normally open thermal switch contacts from pin 31 to 33.



If shorted, then disconnect rest of cable from J5 (Pilot PCB) and J14 (Analog PCB).

a. If short remains then replace ribbon cable.

b. If no short then replace Pilot PCB.

4. Defective Logic PCB

With ribbon cable in place, check voltage at J18 pin 31 to 33.

a. If voltage measured is approximately 15vdc then replace Logic PCB.

C. AC indicator ON; TEMP indicator ON (red); System will pilot (RUN/PURGE/SET switch must be in RUN)

1. Open Display Ribbon Cable or defective Display PCB

Check continuity on Display Ribbon Cable from J20-5 (Logic PCB) to J10-5 (Display PCB).

a. If cable has open, replace cable.

b. If cable has continuity, replace Display PCB

2. Defective Logic PCB

Jumper pin 4 to 5 at J20 (Logic PCB).

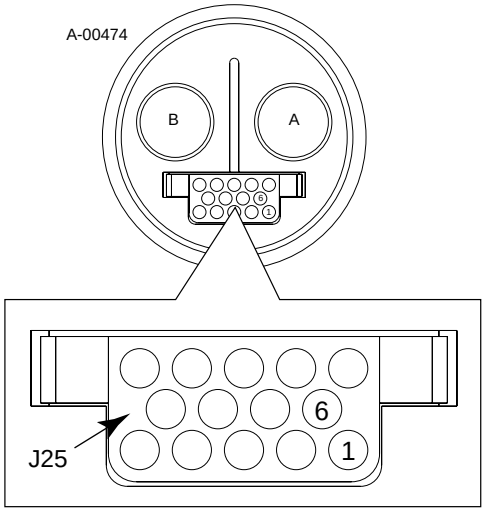
a. If TEMP indicator turns green then replace Logic PCB

D. AC indicator ON. TEMP indicator ON (green); No gas flow; Gas, DC, and PILOT indicators OFF; Two left decimal points on digital display flashing.

Disconnect Torch from Control Module and check for short between J25 pins 1 to 6 in the torch quick disconnect.

If shorted, problem is in Control Module.

If open, problem is in torch.



1. *Torch quick disconnect not tight.*

   a. Tighten quick disconnect connection at Control Module.

2. *Shield cup loose or not installed.*

   a. Tighten or install shield cup.

3. *Parts-In-Place (PIP) pin missing or damaged.*

   a. Refer to appropriate Torch Instruction Manual. and replace pin.

4. *Faulty PIP wire in torch shell enclosure.*

   a. Refer to appropriate Torch Instruction Manual and repair fault.

5. *Open PIP wire in torch leads.*

   a. Refer to appropriate Torch Instruction Manual and repair torch leads.

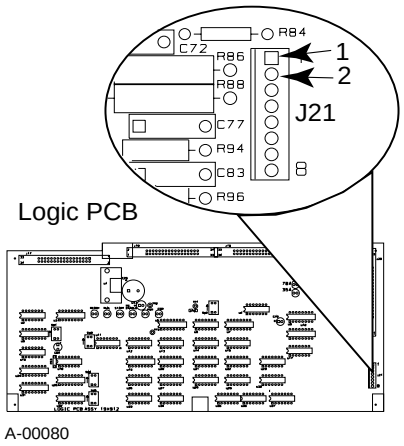
6. *J25 connector (14pin) in quick disconnect loose.*

   a. Install Signal Connector Retrofit Kit (Catalog #9-5848) per instructions with kit.

7. *Defective Logic PCB.*

With Torch connected measure voltage between J21 pin 1 to pin 2 at Logic PCB

   a. Replace Logic PCB if 0 volts.



E. AC indicator ON; TEMP indicator ON (green); No gas flow; Gas, DC, and PILOT indicators OFF.

1. *RUN/PURGE/SET switch in RUN position.*

   a. Switch to SET position.

2. *Gas supply not connected to unit.*

   a. Connect to gas supply.

3. *Gas supply not turned on.*

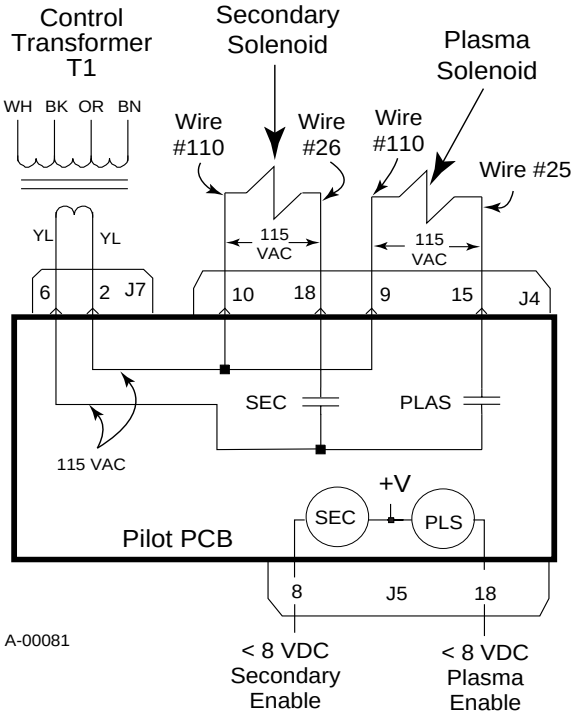
   a. Turn gas supply on.

4. *Defective RUN/PURGE/SET switch.*

   a. Check continuity.

5. *Defective gas solenoid circuit(s).*

Make the following voltage checks per the circuit diagram and replace the faulty part as required:

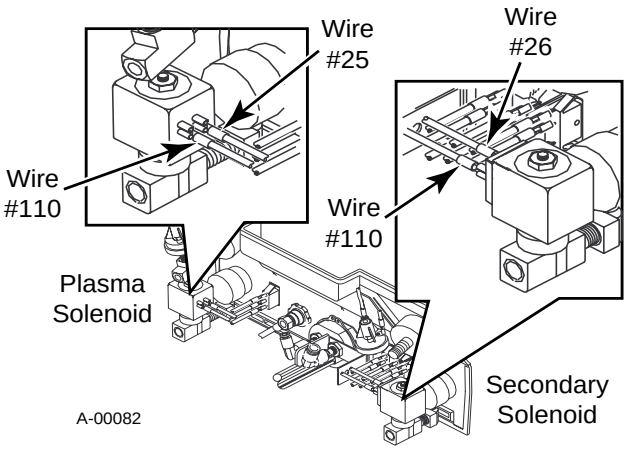


Wire #26 to wire #110 at the secondary solenoid.

a. If approximately 115vac replace solenoid

Wire #25 to wire #110 at the plasma solenoid (not used with PCH / M-35 Torch).

b. If approximately 115vac replace solenoid.



Check Pilot PCB J18-2 to TP1 (GND) for 0 VDC.

c. If higher than 0 VDC, replace Display Ribbon Cable

Pilot PCB J5 pin 8 to TP1 (GND) for secondary solenoid.

d. If higher than 8 VDC, replace Logic PCB.

Pilot PCB J5 pin 18 to TP1 (GND) for plasma solenoid.

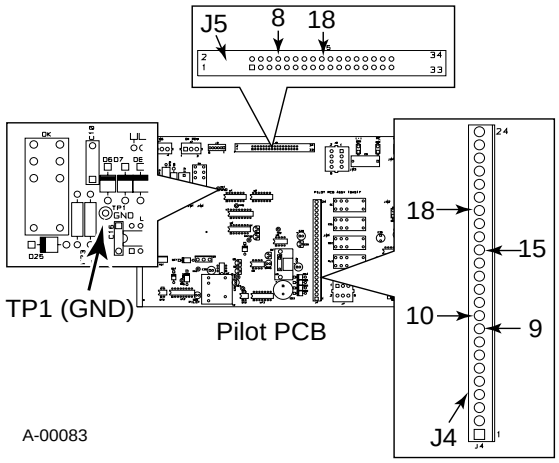
e. If higher than 8 VDC, replace Logic PCB.

J4 pin 10 to 18 on Pilot PCB for secondary solenoid.

f. If not approximately 115 VAC replace Pilot PCB

J4 pin 9 to 15 on Pilot PCB for plasma solenoid.

g. If not approximately 115 VAC replace Pilot PCB



F. AC indicator ON; TEMP indicator ON (green); GAS indicator OFF; Gas flows; DC and PILOT indicators OFF.

1. Gas pressure to low.

a. See torch manual for operating pressures.

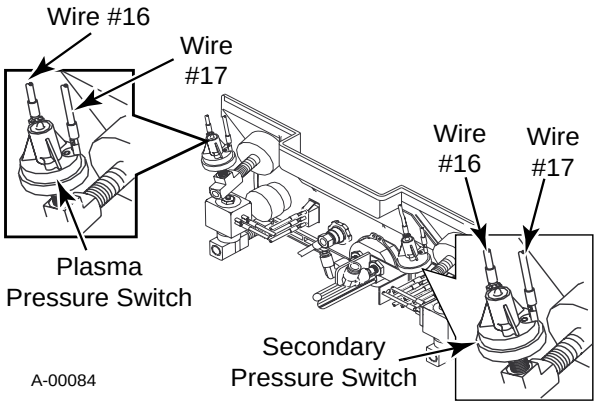
2. Both gas supply hoses not connected.

a. PCH / M-70, 140, and 145 torches require both plasma and secondary.

3. Defective pressure switch.

Measure for DC voltage from wire #16 to wire #17 at the secondary pressure switch at the rear of the Front Panel Assembly.

a. If 15vdc and pressure is above 40 PSI, replace secondary pressure switch.

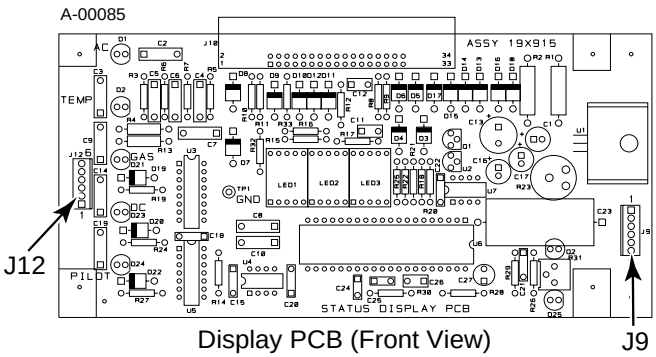


Measure for DC voltage from wire #16 to wire #17 at the plasma pressure switch at the rear of the Front Panel Assembly.

b. If 15vdc and pressure is above 40 PSI, replace plasma pressure switch; when using torch other than PCH / M-35.

4. Loose or bad connection

a. Check connections at J9 (plasma) and J12 (secondary) on the Display PCB Assembly.

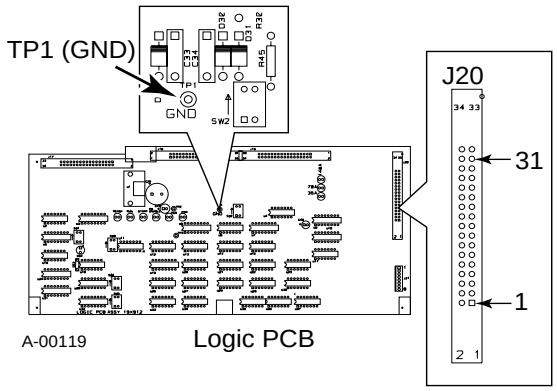


5. Defective Display Ribbon Cable or Logic PCB

Check for DC voltage from Logic PCB J20-1 to TP1 (GND) for secondary or J20-33 to TP1 (GND) for plasma.

a. If less than a volt, replace Logic PCB.

b. If higher than a volt replace ribbon cable.



4.07 Purge Problems

Locate your symptom below:

A. AC indicator ON; TEMP indicator ON (green); Gas flows; GAS indicator ON or OFF; DC and PILOT indicators OFF.

1. RUN/PURGE/SET switch in PURGE or SET position.

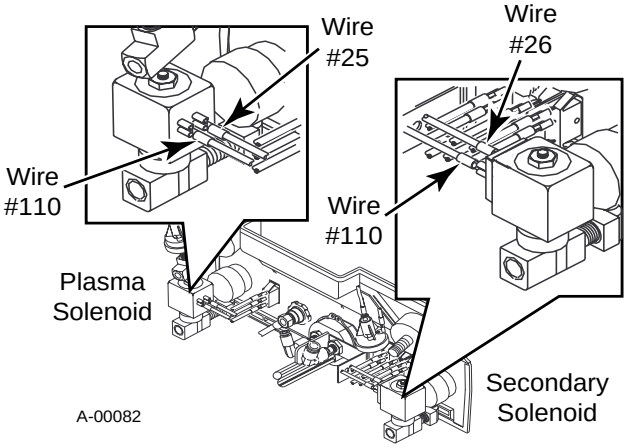
a. Move to RUN position.

2. Defective RUN/PURGE/SET switch.

a. Check continuity.

3. Defective secondary/single gas solenoid.

a. Replace if secondary / single gas flows and voltage between wire #26 to wire #110 measures 0 vac.



4. Defective plasma gas solenoid.

a. Replace if plasma gas flows and voltage between wire #25 to wire #110 measures 0 vac.

5. Defective Pilot PCB

a. Disconnect Pilot Ribbon Cable from Pilot PCB at J5. Replace if gas still flows.

6. Defective Pilot Ribbon Cable

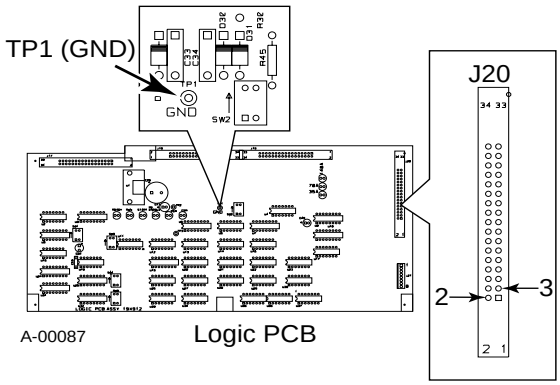
Reconnect Pilot Ribbon Cable to Pilot PCB at J5.

a. Disconnect Pilot Ribbon Cable to Analog PCB at J14 and Logic PCB at J18. Replace if gas still flows.

Reconnect Pilot Ribbon Cable to Analog PCB at J14 and Logic PCB at J18.

7. Defective Logic PCB.

a. Replace if voltages are as follows: J20-2 to common = 15 vdc; J20-3 to common = 0 vdc.



8. Defective Display Ribbon Cable.

a. Replace if J20-3 (Logic PCB connector) to J10-3 (Display PCB connector) is open.

b. Replace if Logic PCB connector J20 pin 2 is shorted to pin 1 or 3.

B. AC indicator ON; TEMP indicator ON (green); Gas flows; GAS, DC and PILOT indicators ON; Arc in torch without pressing torch switch.

1. Defective torch switch.

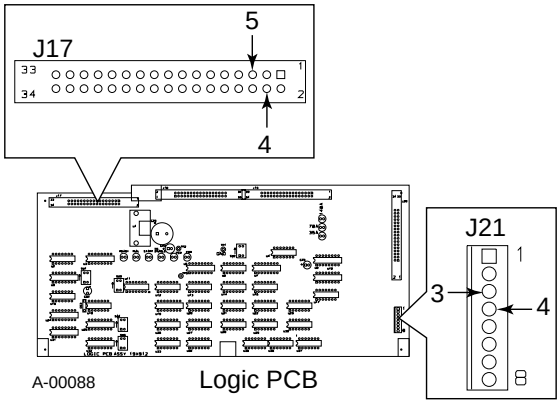
a. Refer to appropriate Torch Instruction Manual and check continuity.

2. Defective torch leads.

a. Refer to appropriate Torch Instruction Manual and check continuity.

3. Defective Logic PCB.

a. Replace if voltages are as follows: J21 pin 3 to 4 = 15 vdc; J17 pin 5 to 4 = 15 vdc.



C. AC indicator ON; TEMP indicator ON (green); No gas flows; GAS, DC and PILOT indicators OFF; Digital display indication is incorrect.

1. Defective Analog PCB.

a. Refer to Section 4.10-A, Module Identification

2. Defective Power Module

a. Refer to Section 4.10-A, Module Identification

3. Defective Logic PCB.

a. Refer to Section 4.10-B, Torch Identification

4. Defective Display PCB.

a. Refer to Section 4.10-C, Potentiometer Scaling

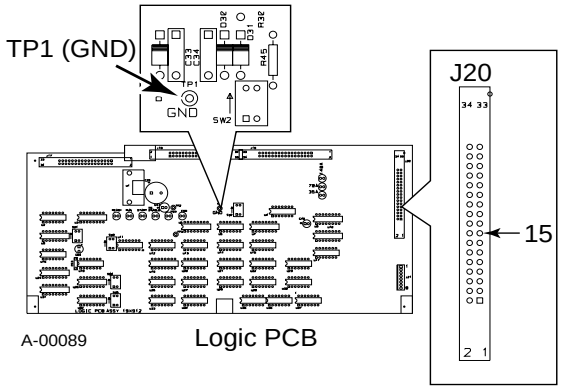
D. AC indicator ON; TEMP indicator ON (green); No gas flows; GAS, DC and PILOT indicators OFF; Digital display OFF

1. Remote cable connected

a. Normal. Remove remote cable from J11 on Rear Panel if not being used.

2. Defective Display PCB

a. Check DC voltage at J20-15 to TP1 (GND) on Logic PCB. If less than 2vdc replace Display PCB.



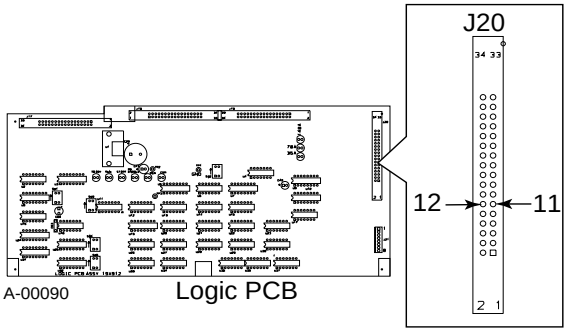
E. CURRENT control adjustment does not change digital display. All three decimal points are ON indicating corner slowdown.

1. Dust/debris blocking sensor on Display PCB.

a. Clean PCB.

2. Defective Display PCB.

a. Check for DC voltage between J20 -11 to 12 on Logic PCB. If voltage is less than 10vdc replace Display PCB.



3. Corner slowdown (CSD) from remote ON, if used

Disconnect remote interface cable from J11 on Control Module rear panel.

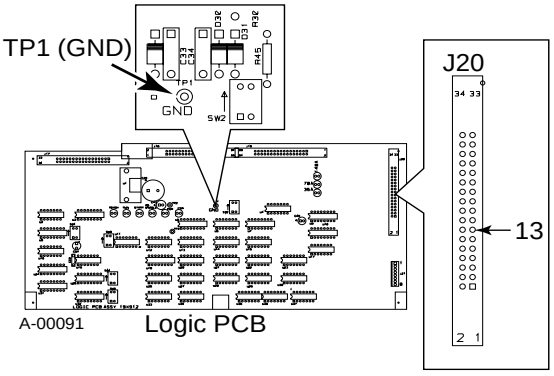
a. If decimals go OFF, problem is in remote system

Disconnect remote ribbon cable from Analog PCB J13 and Logic PCB J17.

b. If decimals go out, replace Remote Interface Assembly.

4. Defective Analog PCB.

a. Check for DC voltage between J20-13 to TP1 (GND) on Logic PCB. If Voltage is less than 2vdc replace Analog PCB.



5. Defective Display Ribbon Cable.

a. Check for DC voltage between J20-13 to TP1 (GND) on Logic PCB. If Voltage is less than 2vdc replace Display Ribbon Cable.

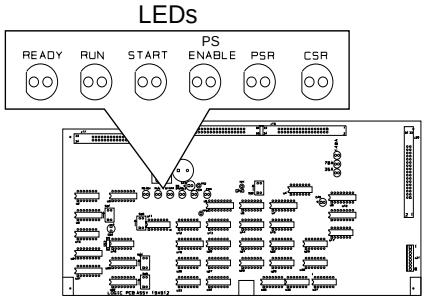
4.08 Pilot Arc Problems

Locate your symptom below:

A. AC indicator ON; TEMP indicator ON (green); No gas flow; GAS, DC and PILOT indicators OFF.

1. RUN/PURGE/SET switch not in RUN or defective

a. Check RUN and READY LEDs on Logic PCB. If READY on and RUN off check RUN/PURGE/SET switch. If remote is used check for RUN setting.



2. Defective hand torch parts (leads, switch or quick disconnect).

Check START LED on Logic PCB. If ON, torch parts are okay.

If OFF, on Logic PCB check for approximately 10K ohms between J21 pins 3 to 4 with torch switch pressed.

a. Replace Torch parts as needed per appropriate Torch Instruction Manual if no continuity.

3. Defective Logic PCB

Check START LED on Logic PCB. If OFF, on Logic PCB check for approximately 10K ohms between J21 pins 3 to 4 with torch switch pressed.

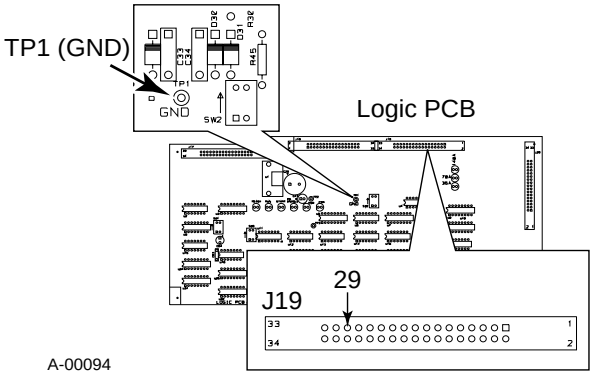
a. Replace Logic PCB if zero ohms or a small reading.

4. Remote Cable Disconnected (RC6045 Remote Accessory used).

a. Check READY LED on Logic PCB. If READY LED is off check remote E-STOP.

5. Coolant flow low if PCH/M-145 Torch is used

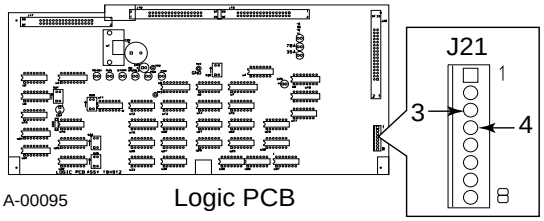
a. Check for DC voltage on Logic PCB between J19-29 to TP1 (GND). If voltage is more than 2vdc coolant flow low, coolant module defective or check for plugged torch.



5. Defective Logic PCB.

RUN and READY LEDs on Logic PCB should be ON.

a. Replace if voltage on Logic PCB between J21-3 to 4 measures 0 vdc when torch switch pressed.



B. AC indicator ON; TEMP indicator ON (green); Gas flows; GAS indicator ON; DC indicator OFF; PILOT indicator ON momentarily

1. High input line voltage.

a. Refer to Operating Manual 0-2463, Section 3.05, for proper input voltage.

C. AC indicator ON; TEMP indicator ON (green); Gas flows; GAS indicator ON; DC indicator OFF; PILOT indicator blinks; Power Module DC indicators may OFF, flicker or blinking; Small arc may be visible in torch.

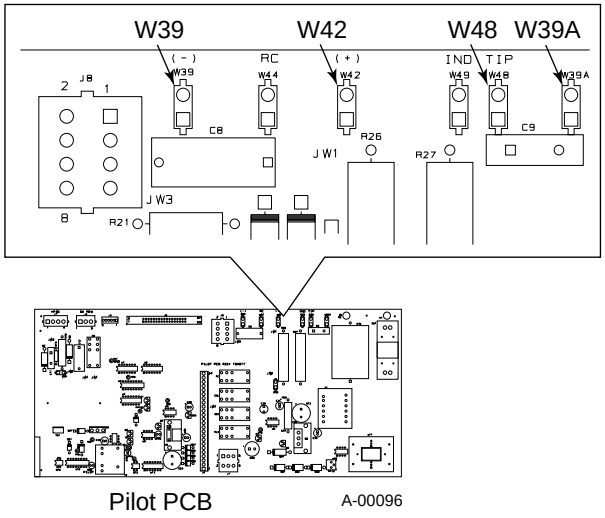
1. Defective Pilot PCB or Power Module

With wires attached check across W39 to W42 at the Pilot PCB. There should be a diode drop across W39 to W42 in one direction and an open in the other.

If shorted remove the wires at W39 and W42 at the Pilot PCB and check again.

a. Replace Pilot PCB if shorted from W39 to W42 (with wires #39 and #42 removed)

b. Defective Power Module. Refer to Section 4.10-D, No DC Output. and Section 4.10-E-2, Output Diode Check.



2. Defective Pilot PCB or Torch

With wires attached check across W39A to W48 at the Pilot PCB. There should be a diode drop across W39A to W48 in one direction and an open in the other.

If shorted remove Torch and check again.

a. If shorted from W39A to W48 replace Pilot PCB.

b. Defective Torch Assembly. Refer to appropriate Torch Instruction Manual.

3. Defective Logic PCB.

a. Refer to Section 4.10-D, No DC Output. Replace if PS Enable LED on Logic PCB does not flash on or stay on after preflow delay.

D. AC indicator ON; TEMP indicator ON (green); Gas flows; GAS indicator ON; DC indicator ON; PILOT indicator OFF; No arc in torch; Top Power Module DC indicator ON and fans operate; Display indicates 00 and decimal points OFF; CSR LED on Logic PCB ON.

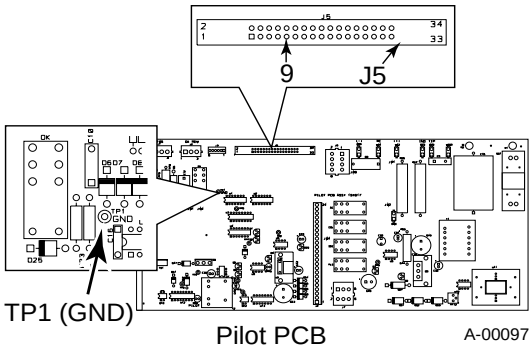
1. Defective Pilot PCB or Pilot Ribbon Cable

Measure DC voltage between J5-9 to TP1 (GND) on Pilot PCB.

If voltage measures less than 2 VDC remove ribbon cable from J5.

a. If voltage measures less than 2 VDC replace Pilot PCB.

b. If voltage is greater than 2 VDC replace Pilot Ribbon Cable.

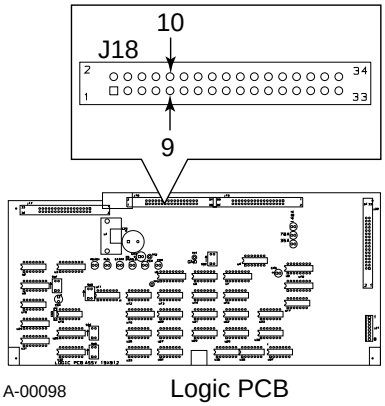


2. Defective Logic PCB or pilot ribbon cable

Measure DC voltage between J18-9 to J18-10 on Logic PCB.

a. If voltage is approximately 15 VDC replace Logic PCB.

b. If voltage measures less than 12 VDC replace Pilot Ribbon Cable.

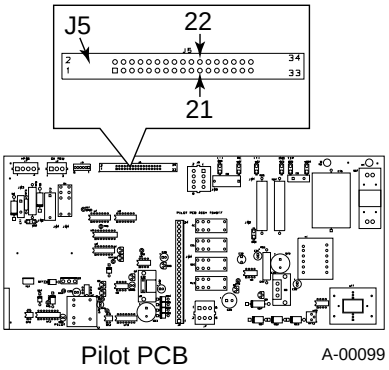


E. AC indicator ON; TEMP indicator ON (green); Gas flows; GAS indicator ON; DC and PILOT indicators ON; No arc in torch; No arc at spark gap on Pilot PCB; PSR LED on Logic PCB OFF.

1. Defective Pilot PCB.

Measure DC voltage between J5-21 to J5-22 on Pilot PCB.

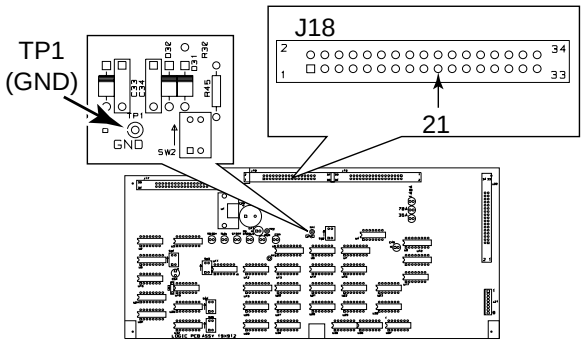
a. If voltage is less than 2 vdc replace Pilot PCB.



2. Defective Logic PCB

Measure DC voltage between J18-21 to TP1 (GND) on Logic PCB.

a. If voltage is more than 8 vdc replace Logic PCB.



F. AC indicator ON; TEMP indicator ON (green); Gas flows; GAS, DC and PILOT indicators ON; Spark at gap and PSR LED on Logic PCB OFF; No arc or intermittent arc in torch; Top Power Module DC indicator ON and fans operate.

1. Gas pressure(s) set incorrectly (too high).

a. Refer to appropriate Torch Manual.

2. Oil/moisture in air lines.

a. Purge system. If problem corrected add filters in line with air source.

3. Incorrect torch parts.

a. Refer to appropriate Torch Instruction Manual.

4. Defective leads.

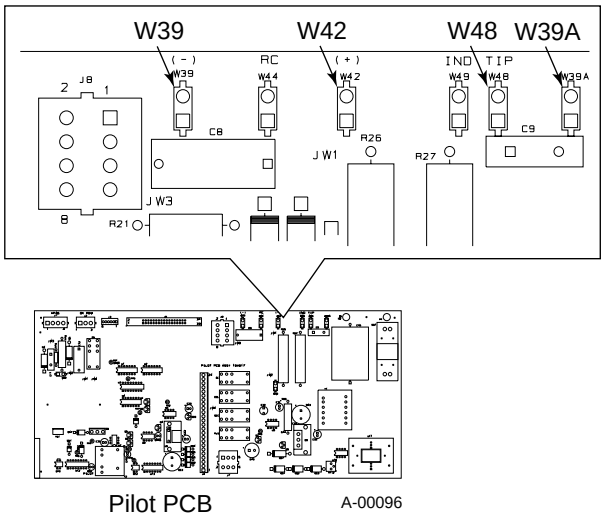
a. Check continuity per appropriate Torch Instruction Manual.

5. Defective torch.

a. Check continuity per appropriate Torch Instruction Manual.

6. Faulty connection of wire #48 or # 39A to Pilot PCB.

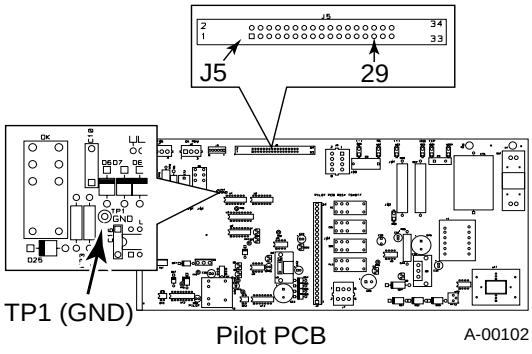
a. Check wiring connection.



7. Faulty Pilot PCB, Logic PCB or Pilot Ribbon Cable.

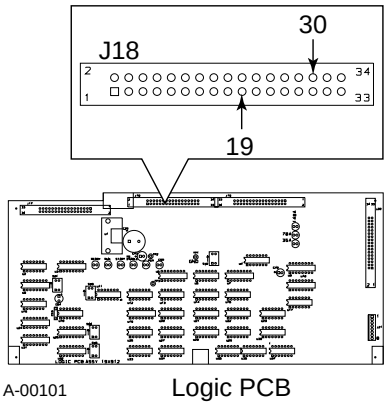
Measure DC voltage between J5-29 to TP1 (GND) on Pilot PCB.

a. If voltage measures less than 2 VDC replace Pilot PCB.



Measure DC voltage between J18-29 to J18-30 on Logic PCB

a. Replace if voltage is 15 VDC.



b. If problem still exists replace Pilot Ribbon Cable

8. Faulty CD Transformer

Shorted secondary - check for arc jumping across windings.

a. If arc is present across the windings then replace CD Transformer.

b. If arc is not present across windings then replace CD Transformer as it could be damaged internally.

9. Contaminated Coolant (PCH/M-145 torch only)

a. Drain system and replace coolant.

4.09 Main Arc Problems

Locate your symptom below:

A. Main cutting arc will not initiate; PILOT indicator stays ON; Right most decimal point stays ON; Top Power Module DC indicator ON.

1. Work cable not connected.

a. Connect work cable.

2. Defective Pilot PCB.

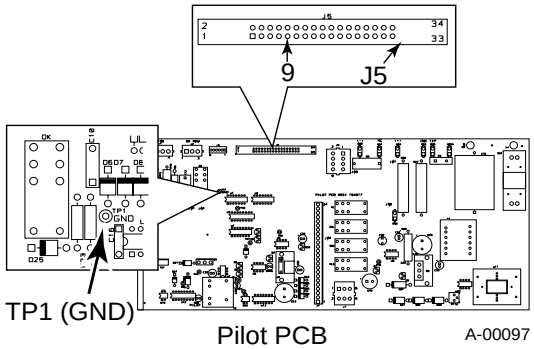
Check for continuity between W42 to W48 on Pilot PCB.

a. Replace Pilot PCB if shorted or low ohms.

Check CSR LED on Logic PCB. Indicator should be ON during main arc transfer.

If indicator is OFF then using an analog meter measure DC voltage between J5-9 to TP1 (GND) on Pilot PCB while attempting to transfer.

b. Replace Pilot PCB if voltage measures less than 2 VDC.

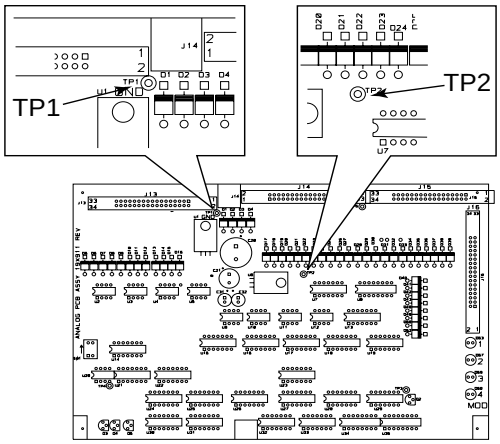


Pilot PCB A-00097

B. Cutting arc transfers, may sputter, when torch is very close to work piece but is weak; Digtal display indicates current set by CURRENT control and right most decimal point is OFF.

3. Defective Analog PCB.

Measure DC voltage between TP2 to TP1 (GND) on Analog PCB.



A-00475 Analog PCB

a. Replace Analog PCB if voltage measures less than 2 VDC.

C. When operating at amperages over 46 amps the digital display drops to 46 amps after main cutting arc initiates.

1. Cutting tip in contact with the work piece.

a. Maintain standoff distance 1/8"-3/8" between cutting tip and work piece.

2. Open pilot wire in Torch.

a. Refer to appropriate Torch Instruction Manual.

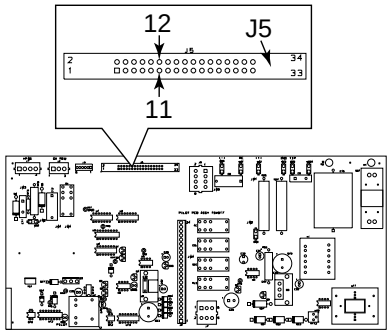
3. Defective Pilot PCB.

Measure for open or high ohms between W49 to W42 on Pilot PCB.

a. Replace Pilot PCB if shorted or low ohms.

Measure DC voltage between J5-11 to 12 on Pilot PCB while cutting and tip not on work.

b. Replace Pilot PCB if voltage is less than 2 vdc.



Pilot PCB A-00105

3. Defective Analog PCB.

Measure DC voltage between J5-11 to 12 on Pilot PCB.

a. Replace Analog PCB if voltage measures 15 vdc.

D. Low cutting power; Digital display indicates amperage less than preview current.

1. Defective Power Module.

a. Test each Power Module seperately.

4.10 Test Procedures

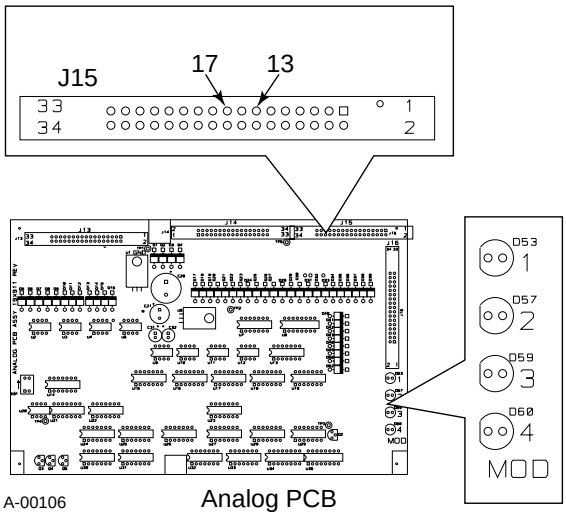
A. Module Identification

There are four light emitting diodes (LED) located on the Analog PC Board of the Control Module that are used as a visual indicator of the number of Power Modules in the Stak system. Only one LED will be on at a time as shown in the following table:

LED Indicator	Number of Power Modules
MOD 1	1
MOD 2	2
MOD 3	3
MOD 4	4

The number of Power Module units determines the resistance value measured between J15-13 and J15-17 on the Analog PCB in the Control Module. Each Power Module has a 10 K ohm resistor connected between J26-1 to J26-2. When each Power Module is connected to the system the 10 K ohm resistors are connected in parallel. If the modules are correctly installed the resistance measured at the Analog PCB between J15-13 to 17 is as follows:

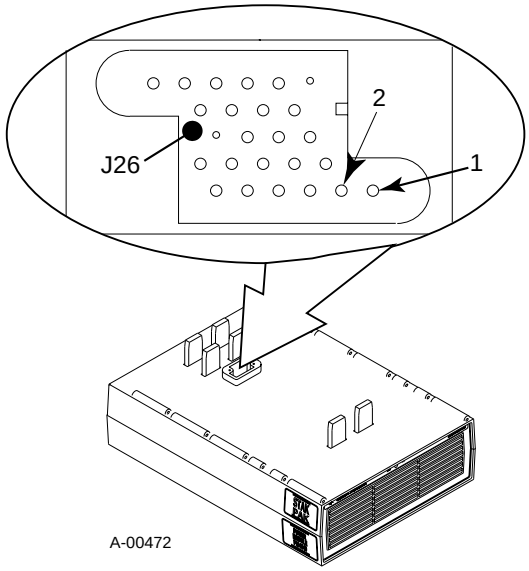
Number of Power Modules	J15 Pin 13 to 17 Resistance Reading
1	10K ohms
2	5K ohms
3	3.3K ohms
4	2.5K ohms



A-00106 Analog PCB

If the resistance is correct for the number of Power Module units connected but the module identification LED is incorrect then replace the Analog PCB.

If the resistance is incorrect then seperate the Power Modules and check for 10 K ohm resistance on each unit between J26-1 to J26-2.

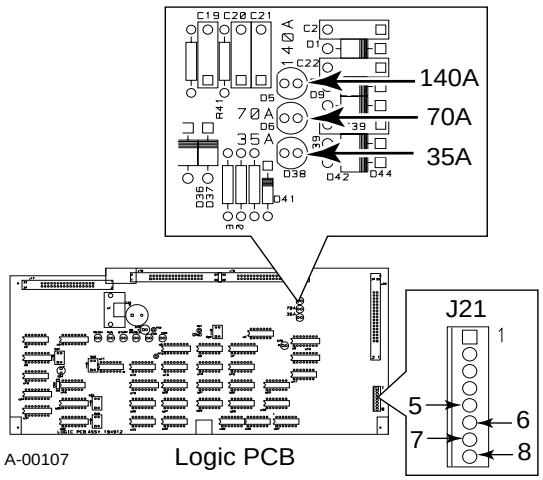


A-00472

B. Torch Identification

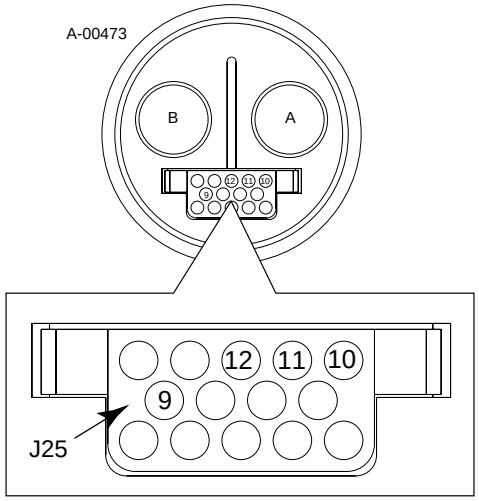
Three light emitting diodes (LEDs) on the Logic PC Board indicate which torch is connected to the Control Module. Only one LED will be on at a time per the following table:

Indicator ON	Model Torch
35A	PCH/M-35
70A	PCH/M-70
140A	PCH/M-140 or 145



The identity of the torch is determined by the voltages found between J21-5, J21-6, and J21-7 to J21-8 on the Logic PCB. Each torch has jumper wires inside the 14 pin connector inside the torch quick disconnect. One or more of the identifying pins J21-5, J21-6, or J21-7 are connected to J21-8 (common) via the jumpers. If the torch idenity is correct, continuity will be found at J25 connector (part of TORCH connector) for the following pins:

J25 Pins	Model Torch
11 and 12	PCH/M-35
9 and 12	PCH/M-70
9, 10 and 12	PCH/M-140
9, 10, 11 and 12	PCH/M-145



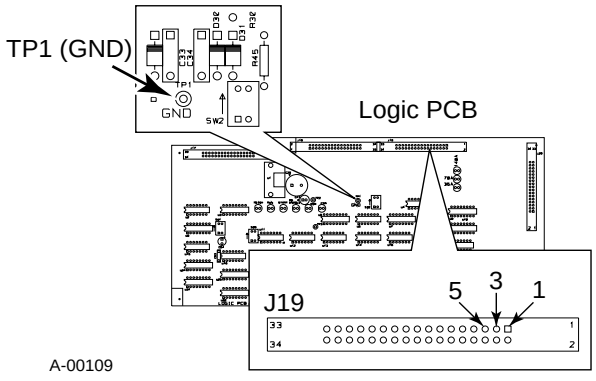
The torch ID inputs, which normally are 15 VDC with respect to J21-8 will be 0 VDC depending on the torch used as follows:

Model Torch	J21 Pins
PCH/M-35	11
PCH/M-70	9
PCH/M-140	9 and 10
PCH/M-145	9, 10 and 11

If the voltages for the torch ID at the J21 connector are correct but the torch identification LED is incorrect then replace the Logic PCB.

If the torch identification LED is correct then the torch ID signal from the Logic PCB to the Analog PCB should be checked at J19 on the Logic PCB. These pins are normally 15 VDC with respect to TP1 (GND). Depending on the torch used the voltage will be as follows:

Model Torch	J19 Pins	Volts DC
PCH/M-35	1	0
PCH/M-70	3	0
PCH/M-140 or 145	1, 3 and 5	15



If the torch identification signals to the Analog PCB are incorrect then replace the Logic PCB.

C. Potentiometer Scaling

The Control Module Analog PC Board receives the torch and module identification signals which then provides the high and low voltages for the current control potentiometer. The total current output is divided equally between all Power Module's and is set not to exceed the torch rating. The potentiometer high and low voltage with respect to PCB common (TP-1 on Logic PCB) are as follows:

Number of Power Modules	Model Torch	Pot High J16-25 Volts DC	Pot Low J16-23 Volts DC
1	PCH/M-35	10	3.96
1	PCH/M-70	10	3.96
1	PCH/M-140	10	3.96
1	PCH/M-145	10	3.96
2	PCH/M-35	5	2
2	PCH/M-70	10	2
2	PCH/M-140	10	2
2	PCH/M-145	10	2
3	PCH/M-35	3.33	1.33
3	PCH/M-70	6.67	1.33
3	PCH/M-140	10	1.33
3	PCH/M-145	10	1.33
4	PCH/M-35	2.5	1
4	PCH/M-70	5	1
4	PCH/M-140	10	1
4	PCH/M-145	10	1

This chart shows the normal potentiometer voltages supplied by the Analog PCB at J16.

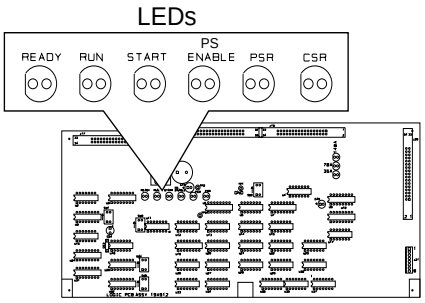
The checks should be made in preview mode with CURRENT control potentiometer and corner-slow-down (CSD) trimpot set to maximum. The digital display should indicate the potentiometer setting and the decimal point on the right side of the display should be ON.

If the torch and module identification signals to the Analog PCB are correct and the output potentiometer high and low voltages are incorrect replace the Analog PCB.

If the potentiometer high and low voltages are correct but the display is incorrect then replace the Display PCB.

D. No DC Output

An open circuit voltage of approximately 280 to 380 VDC (depending on input power selected) is produced when switching transistors in the Power Module are turned ON by an “enable” signal from the Control Module Logic PCB. A circuit on the Pilot PCB monitors the output voltage. When the output voltage drops below 60 VDC, indicating a problem exists, the Pilot PCB sends a signal back to the Logic PCB which turns OFF the “enable” signal to the Power Module. Because this happens in less than 50 milliseconds, it is not easy to take voltage readings to find the source of the problem.



The following light emitting diodes (LED's) on the Logic PCB will help in troubleshooting:

Indicator	Meaning
READY	Indicates that E-STOP, TEMP switches, coolant flow, and parts-in-place circuits are satisfied. This signal must be ON to allow RUN to come ON.
RUN	Indicates that the RUN/PURGE/SET or remote RUN/PURGE switch is in the RUN position. Signal must be ON to allow PS Enable to come ON.
START	Indicates a start signal from a hand torch switch, CNC, remote panel or pendant is being supplied.
PS ENABLE	Indicates that the enable signal to the top Power Module is ON.
PSR	Indicates that at least 4 amps of DC current is being supplied from Power Module. It is used to indicate when a true pilot arc has started.
CSR	Indicates main cutting arc is established.

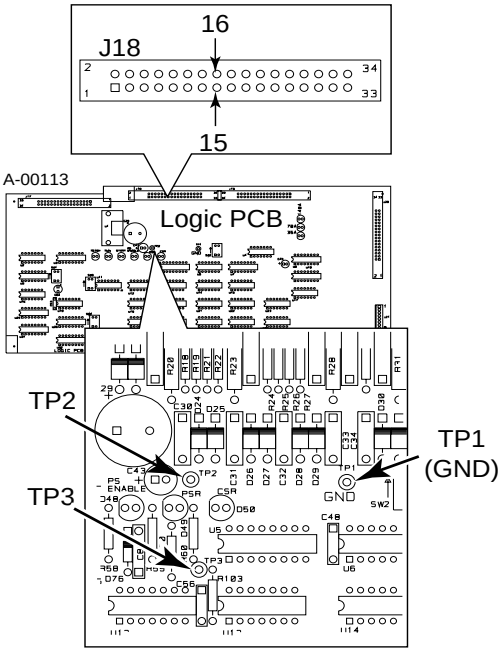
When the unit is at “idle” the RUN and READY LED should be on. The START LED turns on when start signal is given. At this point the gas or gases begin to flow. When the preflow time is over the PS Enable signal is given and the DC LED on the top Power Module turns ON. When the pilot arc is established the PSR LED turns ON.

If the PS Enable LED does not come ON then replace the Logic PCB.

If the PS Enable LED turns ON then OFF immediatly, the following test should be performed:

1. Jumper Logic PCB TP3 to TP1 to disable capacitive discharge (CD).

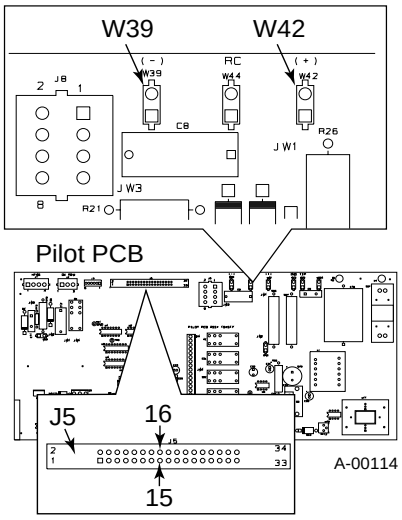
2. Connect a jumper between TP1 and TP2 test points on the Logic PCB. This will cause the gas or gases to flow continuously and the DC indicator on the Control Module to turn ON.



3. Press hand torch switch or send remote start signal (START LED turns ON).

4. After preflow delay the PS Enable LED turns ON and the top Power Module DC indicator turns ON.

5. Measure open circuit voltage between wire #39 to #42 at the Pilot PCB. If voltage is low, each Power Module should be tested individually. If voltage iscorrect then continue to Step 6.



6. Measure the voltage between J5-15 to J5-16. If the voltage is 15 VDC replace the Pilot PCB. If the voltage is less than 2 VDC then continue to Step 7.

7. Measure the voltage between J18-15 to J18-16. If the voltage is 15 VDC replace pilot ribbon cable. If the voltage measures less than 2 VDC then replace Logic PCB.

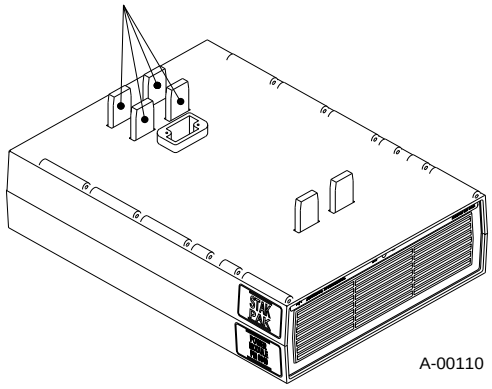
E. Power Module Checks

1. Input Bridge Check

Separate each Power Module in the stack. With an ohmmeter set on Rx1, check continuity between the four input power stakes on each Power Module. Each stake when checked to the other three should measure an open circuit (no continuity).

If continuity is found then the Power Module should be repaired (refer to Power Module Service Manual 0-2456) or send the unit to an authorized repair facility.

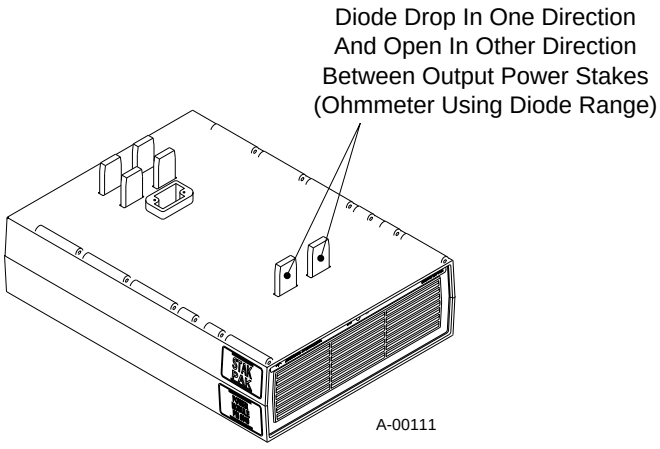
No Continuity Between
Input Power Stakes
(Ohmmeter Using Rx1)



2. Output Diode Check

Separate each Power Module. With an ohmmeter set on the diode range, check between the two output power stakes. This should indicate a diode drop in one direction and open in the other.

If the checks indicate open or shorted in both directions then the Power Module should be repaired (refer to Power Module Service Manual 0-2456) or send the unit to an authorized repair facility.



SECTION 5: REPAIRS & REPLACEMENT PROCEDURES

5.01 Introduction

This Section describes parts replacement procedures and all cable repairs which may be performed on the STAK PAK® Control Module.

Under not circumstances are field repairs to be attemped on Printed Circuit or other Subassemblies of this unit. Evidence of unauthorized repairs may void the factory warranty.

5.02 Anti-Static Handling Procedures

A. General

CAUTION

PC boards can be irreparably damaged by improper handling due to electrostatic discharge (ESD).

Replacement PC boards are shipped in a protective enclosure to prevent damage from electrostatic discharge (ESD) during shipping. Included with each replacement board is a ground strap to prevent static damage during installation.

WARNINGS

Read and understand these instructions and the instructions on the grounding wrist strap package before opening the power supply enclosure or removing the replacement PC board from its protective enclosure.

Disconnect primary power to the system before disassembling the torch, torch leads, or power supply enclosure.

Do not operate the power supply or test equipment under power while wearing the grounding wrist strap.

B. Procedure

1. Open the wrist strap and unwrap the first two folds of the band. Wrap the adhesive side firmly around your wrist.
2. Unroll the rest of the band and peel the liner from the copper foil at the opposite end.
3. Attach the copper foil to a convenient and exposed electrical ground.
4. Connect the power supply primary cable ground to the same electrical ground as the wrist strap.
5. Open the power supply enclosure (see instruction manual for the power supply) and remove the failed PC board.
6. Carefully open the ESD protective bag and remove the replacement PC board.
7. Install the replacement PC board in the power supply and make all necessary connections.
8. Place the failed PC board in the ESD protective bag and seal for return shipping.
9. Reassemble the power supply enclosure (see instruction manual for the power supply).
10. Remove the grounding wrist strap from your wrist and from the electrical ground connection before reconnecting primary power to the power supply.

5.03 Disassembly & Replacement

WARNING

Disconnect primary power at the source before assembling or disassembling stacked modules, individual modules, torch parts, or torch and leads assemblies.

A. Removal of Control Module Cover

1. Remove the two module assembly pins from the rear of the Control Module.

2. Lift the upper enclosure (cover) from the lower enclosure to gain access to the interior of the unit.

3. Close the unit reversing the above procedure.

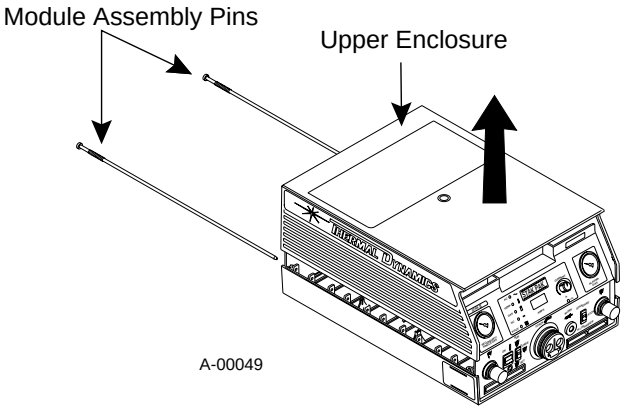


Figure 5-1: Removing Control Module Cover

B. Fuse Replacement

1. Open the Control Module as described in paragraph "A" above.

2. Locate and remove the old fuse.

3. Install the replacement fuse and close up the Control Module by reversing the procedure in Step 1..

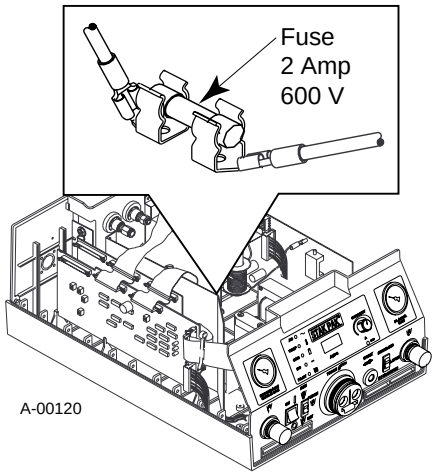


Figure 5-2: Fuse Location

C. Logic PCB Assembly Replacement

1. Open the Control Module as described in paragraph "A" above.

2. Carefully remove all cable connections to the Logic PCB Assembly noting the location of each.

3. Slide the PCB up and out of the board holders located in the bottom of the unit.

4. Set the switches on the replacement PCB the same as the one removed.

NOTE

Be sure that the switches on the replacement PCB are set the same as the old PCB.

5. Reinstall the replacement Logic PCB Assembly by reversing the above procedure and noting the following:

Connector	Description of Cable
J17	Ribbon cable from optional J11 Remote Interface if installed and the Analog PCB
J18	Ribbon cable from Analog and Pilot PCBs
J19	Ribbon cable from Power Module Interface and Analog PCB
J20	Ribbon cable from Analog and Display PCBs
J21	Wiring harness from Quick Disconnect on Front Panel

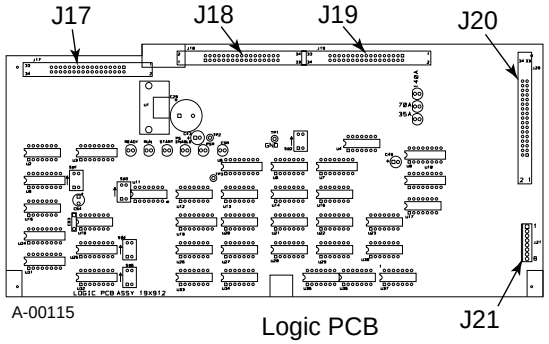


Figure 5-3: Logic PCB Assembly Connections

D. Analog PCB Assembly Replacement

1. Open the Control Module as discribed in paragaph "A" above.

2. Carefully remove all cable connections to the Analog PCB Assembly noting the location of each.

3. Slide the PCB up and out of the board holders located in the bottom of the unit.

4. Reinstall the replacement Analog PCB Assembly by reversing the above procedure and noting the following:

Connector	Description of Cable
J13	Ribbon cable from optional J11 Remote Interface if installed and the Logic PCB
J14	Ribbon cable from Logic and Pilot PCBs
J15	Ribbon cable from Power Module Interface and Logic PCB
J16	Ribbon cable from Logic and Display PCBs

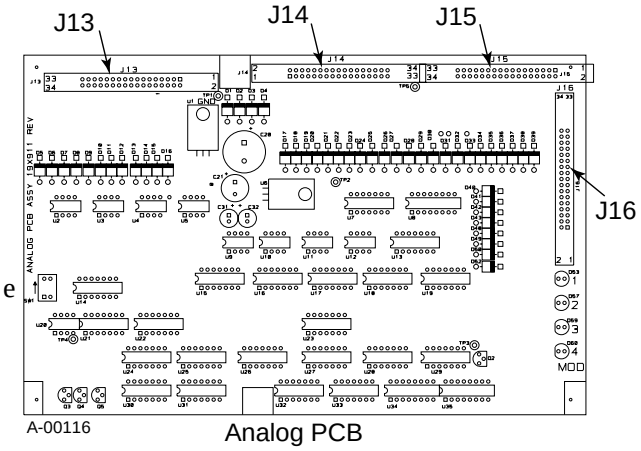


Figure 5-4: Analog PCB Assembly Connections

E. Pilot PCB Assembly Replacement

1. Open the Control Module as discribed in paragaph "A" above.

2. Press together the sides of the two plastic pins securing the Control Module Baffle which covers part of the Pilot PCB and the fan.

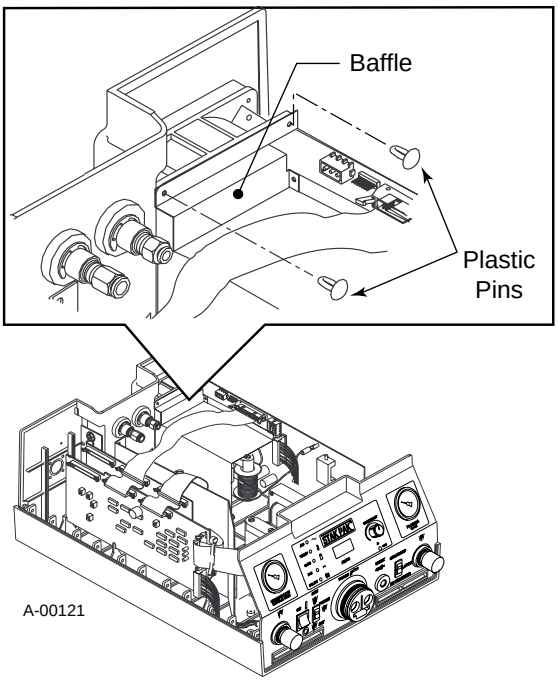


Figure 5-5: Control Module Baffle Removal

3. Remove the Control Module Baffle.

4. Carefully remove the all cable connections to the Pilot PCB Assembly noting the location of each. There is a large wire in the lower front corner of the PCB. This wire is the plus(+) power connection and runs through a current senor on the PCB. The wire goes to the WORK connector on the Front Panel Assembly and the other end goes to the plus (+) Power Module Stake connection. Note which end of the wire goes to which location.

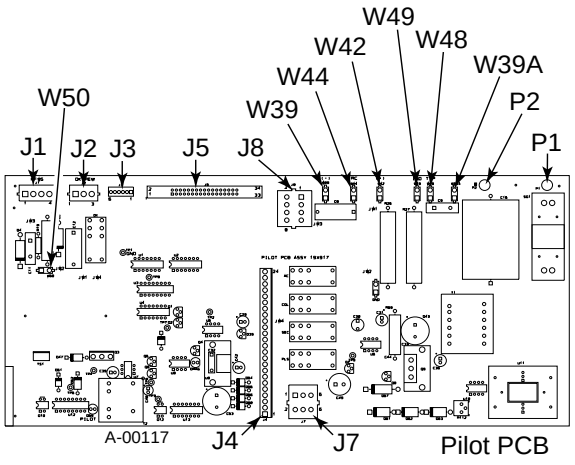


Figure 5-6: Pilot PCB Assembly Connections

5. Remove the screw securing the brace to the Pilot PCB.

6. Slide the PCB up and out of the board holders located in the bottom of the unit.

7. Reinstall the replacement Pilot PCB Assembly by reversing the above procedure and noting the following:

Connector	Description of Cable
J1	Cable from optional High Flow Water Shield if installed
J2	Cable from optional Remote Interface if installed
J3	Remove jumper from old PCB if not on replacement and install same as on old PCB (OK to Move Select- contacts or 36 vac)
J4	Cables to the fan, plasma and secondary solenoids, Power Module Interface, and ON/OFF switch
J5	Ribbon cable from Analog and Logic PCBs
J7	Cable from Auxiliary Transformer
J8	Cable from optional Standoff Control if installed
W#	Connect each wire to it's corresponding wire # terminal

CAUTION

Make sure the ends of the large wire on the Pilot PCB get connected to the proper place.

F. Display PCB Assembly Replacement

1. Open the Control Module as described in paragraph "A" above.

2. Loosen the screw securing the current control knob and remove the knob.

3. Remove the ribbon cable from the cable clamp.

4. Remove the four screws securing the Display PCB to the Front Panel Assembly,

5. Carefully remove the Display PCB far enough to remove the ribbon cable from J10.

6. Remove the connection from J9 (STANDARD/LATCH/HI-TRANSFER switch) and J12 (RUN/PURGE/SET switch).

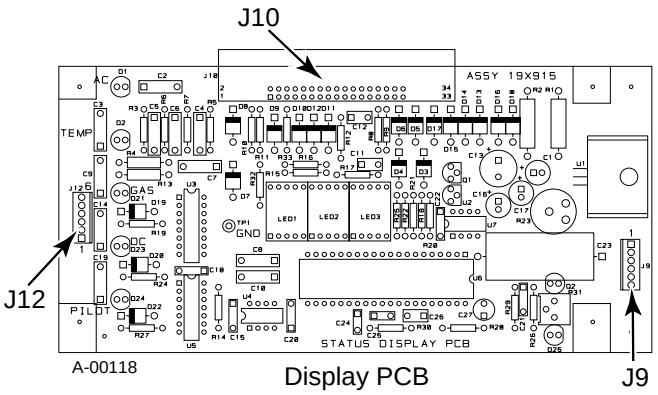


Figure 5-7: Connections on Display PCB Assembly

7. Remove the Display PCB from the unit.

8. Reinstall the replacement Display PCB Assembly by reversing the above procedure.

CAUTION

Make sure that all cables are inserted into the proper connectors.

G. Fan Assembly Replacement

1. Open the Control Module as described in paragraph "A" above.

2. Remove the Control Module Baffle as described in paragraph "E-2" above.

3. Lift the Rear Panel Assembly out of it's slots on the bottom and side panels.. Turn the panel to gain access to the Fan Assembly.

4. Remove the four screws securing the Fan to the Rear Panel.

5. Disconnect the two wires going to the fan power tabs.

6. Reinstall the replacement Fan Assembly by reversing the above procedure.

NOTE

When reinstalling the Rear Panel Assembly into it's holding slots, be sure that no wiring is in the slots and that all wiring is inside the unit.

H. ON/OFF Switch Replacement

1. Open the Control Module as described in paragraph "A" above.

2. Remove the four wires from the ON / OFF Switch.

3. Carefully press down on the tab holding the switch to the Front Panel Assembly.

4. Pull the switch from the panel.

5. Reinstall the replacement ON / OFF Switch Assembly by reversing the above procedure making sure to connect the wiring to the correct switch power tabs.

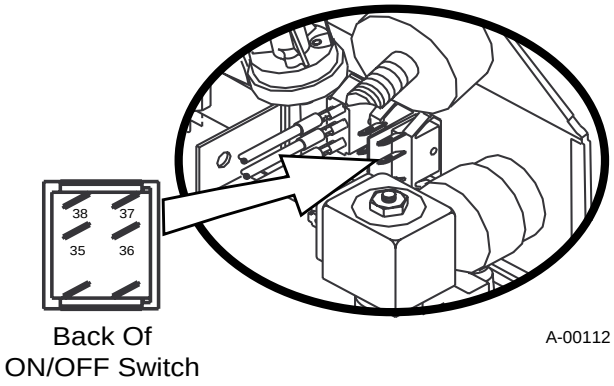


Figure 5-8: ON / OFF Switch Assembly

I. RUN/SET/PURGE Switch Replacement

1. Open the Control Module as described in paragraph "A" above.

2. Remove the three wires from the RUN / SET / PURGE Switch.

3. Carefully press down on the tab holding the switch to the Front Panel Assembly.

4. Pull the switch from the panel.

5. Reinstall the replacement RUN / SET / PURGE Switch Assembly by reversing the above procedure making sure to connect the wiring to the correct switch power tabs.

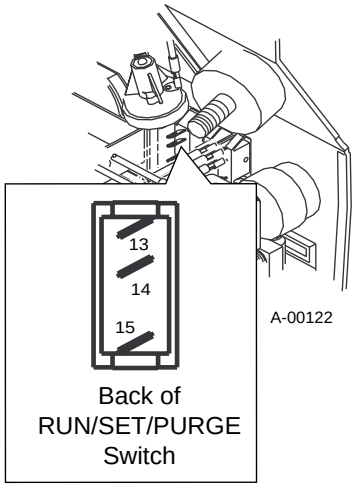


Figure 5-9: RUN / SET / PURGE Switch Assembly

J. STANDARD/LATCH/HI-TRANSFER Switch Replacement

1. Open the Control Module as described in paragraph "A" above.

2. Remove the three wires from the STANDARD / LATCH / HI-TRANSFER Switch.

3. Carefully press down on the tab holding the switch to the Front Panel Assembly.

4. Pull the switch from the panel.

5. Reinstall the replacement STANDARD / LATCH / HI-TRANSFER Switch Assembly by reversing the above procedure making sure to connect the wiring to the correct switch power tabs.

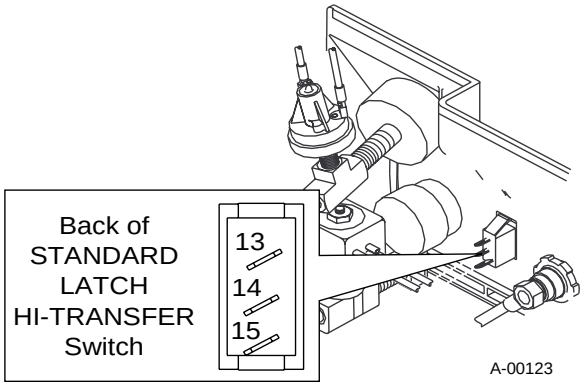


Figure 5-10: STANDARD / LATCH / HI-TRANSFER Switch Assembly

K. Pressure Gauge Assembly Replacement

NOTE

Both the Plasma and Secondary gauges are replaced in the same manner

1. Open the Control Module as described in paragraph "A" above.
2. Disconnect the wiring tho the desired Pressure Switch.
3. Remove the Pressure Switch from the desired Pressure Gauge Assembly.
4. Carefully remove the feeder line, T-connector, nut and clamp from the Pressure Gauge Assembly .
5. Slide the Pressure Gauge out of the Front Panel Assembly.
6. Reinstall the replacement Pressure Gauge Assembly by reversing the above procedure.

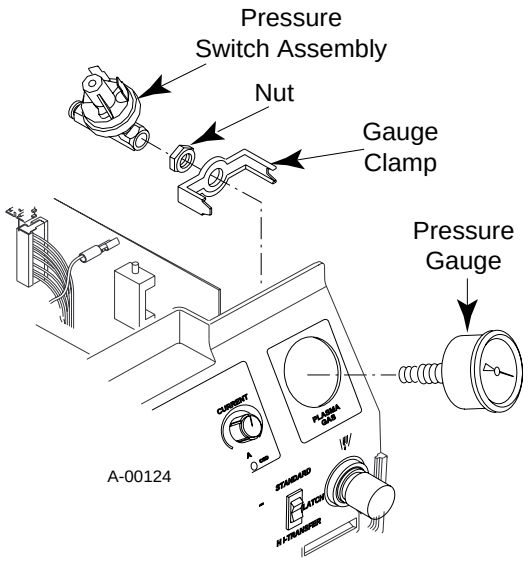


Figure 5-11: Pressure Gauge Assembly

L. Pressure Switch Replacement

NOTE

Both the Plasma and Secondary Pressure Switch Assemblies are replaced in the same manner

1. Open the Control Module as described in paragraph "A" above.
2. Disconnect the wiring from the desired Pressure Switch.
3. Remove the Pressure Switch from the Pressure Gauge Assembly.
4. Reinstall the replacement Pressure Switch Assembly by reversing the above procedure.

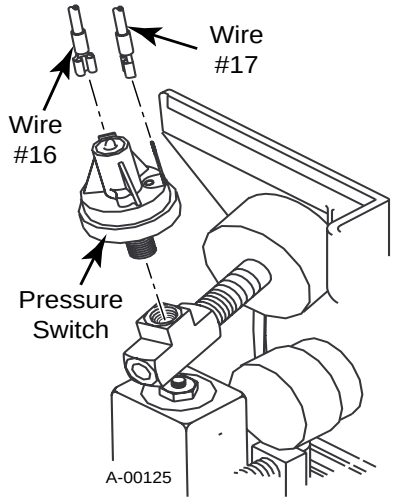


Figure 5-12: Pressure Switch Assembly

M. Plasma or Secondary Regulator/Solenoid Assembly Replacement

1. Open the Control Module as described in paragraph "A" above.

NOTE

Both the Plasma and Secondary Regulator/Solenoid Assemblies are replaced in the same manner

2. Disconnect the wiring from the desired Regulator / Solenoid Assembly.
3. Carefully remove the input and output feeder lines to the assembly.
4. On the Front Panel remove the securing nut for the Regulator / Solenoid Assembly.
5. Slide the Regulator / Solenoid Assembly.out of rear of the Front Panel.
6. Remove the output elbow connector from the old assembly.
7. Reinstall the replacement Regulator / Solenoid Assembly by reversing the above procedure.

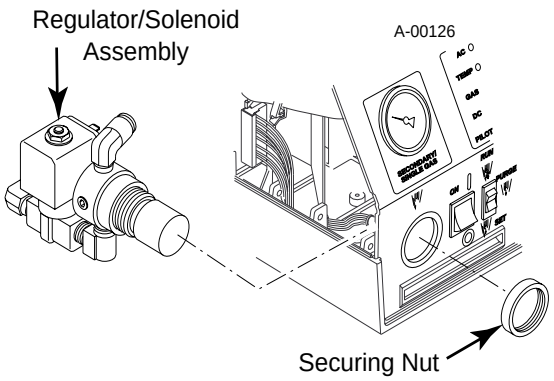


Figure 5-13: Regulator / Solenoid Assembly

N. Capacitive Discharge (CD) Transformer Assembly Replacement

1. Open the Control Module as described in paragraph "A" above.
2. Disconnect the two connections to the Pilot PCB Assembly at P1 and P2.
3. Remove the winding connection from the power Female Blade Connector.
5. Remove the winding connection to the Secondary Quick Disconnect Socket Assembly.
6. Remove the two screws securing the assembly to the bottom of the Control Module.
7. Reinstall the replacement Capacitive Discharge Transformer Assembly by reversing the above procedure.

NOTE

Do not bend any of the wiring or winding leads when installing the replacement. They are formed to the proper angles and must be installed as supplied.

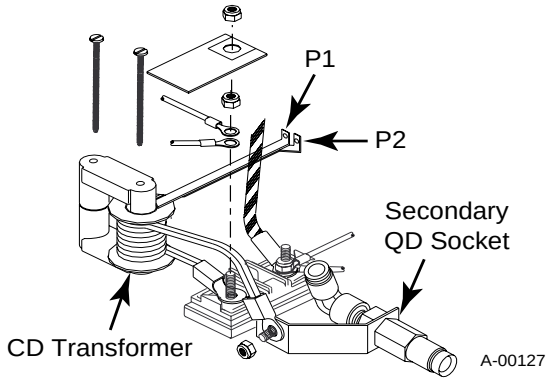


Figure 5-14: CD Transformer Assembly

O. Pilot Inductor Assembly Replacement

1. Open the Control Module as described in paragraph "A" above.
2. Remove the Control Module Baffle as described in paragraph "E-2" above.
3. Disconnect the two connections to the Pilot PCB Assembly at W49 and W50.
4. Remove the two screws securing the assembly to the bottom of the Control Module.
5. Reinstall the replacement Pilot Inductance Assembly by reversing the above procedure.

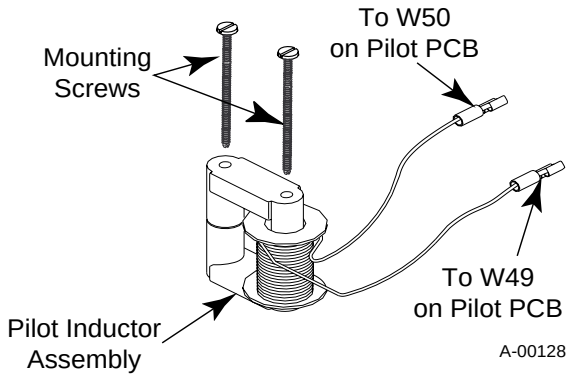


Figure 5-15: Pilot Inductance Assembly

P. Auxiliary Transformer Assembly Replacement

1. Open the Control Module as described in paragraph "A" above.
2. Disconnect J7 at the Pilot PCB Assembly.
3. Disconnect the input connector to the transformer.
4. Remove the four screws and washers securing the Auxiliary Transformer Assembly to the bottom of the Control Module.
5. Reinstall the replacement Auxiliary Transformer Assembly by reversing the above procedure.

Q. Plasma or Secondary Gas Input Fitting Replacement

NOTE

Both the Plasma and Secondary Gas fittings are replaced in the same manner

1. pen the Control Module as described in paragraph "A" above.
2. Turn off any gas supply.

3. Disconnect the external supply line to the fitting being replaced at the Rear Panel.

4. Remove the adapter fitting screwed into the fitting.

5. Remove the internal feed line to the fitting being replaced.

6. Remove the C-clip from the fitting on the inside of the Rear Panel.

7. Pull the fitting from the Rear Panel.

8. Reinstall the replacement Plasma or Secondary Gas Input Fitting Assembly by reversing the above procedure.

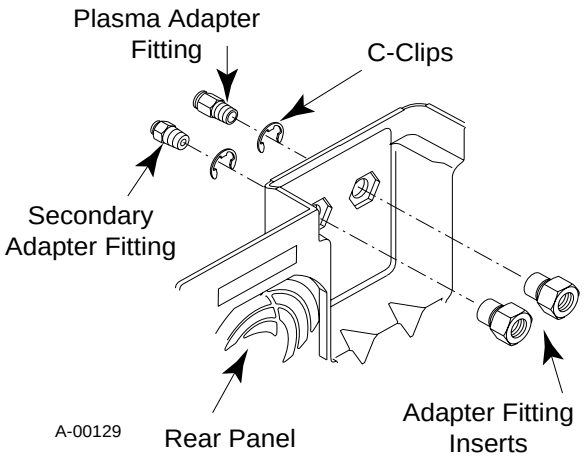


Figure 5-16: Plasma Or Secondary Gas Input Fitting

R. RF Filter PCB Assembly Replacement

1. Open the Control Module as described in paragraph "A" above.

2. Remove the nut securing the RF Filter PC Assembly to the Blade Connector near the front of the unit.

3. Carefully pull the RF Filter Assembly up off the blade lug and remove the wiring connections on the bottom side.

4. Reinstall the replacement RF Filter PCB Assembly by reversing the above procedure.

S. Quick Disconnect Socket Replacement

NOTE

Both the Plasma and Secondary sockets are replaced in the same manner

1. Open the Control Module as described in paragraph "A" above.

2. Disconnect the Torch Leads at the quick disconnect at the Front Panel.

3. Remove the feeder lines at the fitting of the socket to be removed inside the unit per the following:

   a. Push down and hold the quick release on the connector with a screwdriver.

   b. Pull the hose out from the connector.

4. Remove the wiring for the socket per one of the following:

   a. On the Plasma Socket remove the heavy gage wire at the socket.

   b. On the Secondary Socket remove the wiring at its connection to the Logic PCB Assembly (W48).

5. Remove the snap ring on the Socket Assembly inside the Quick Disconnect Body.

6. Push the socket out of the Quick Disconnect Body.

7. Reinstall the replacement Quick Disconnect Socket Assembly by reversing the above procedure and noting the following:

   a. The Secondary Socket has the large feeder line and must be installed to the left as viewed from the outside of the Front Panel.

   b. The wiring lug on the Secondary must be turned to the left as viewed from the outside of the Front Panel and parallel to the unit base.

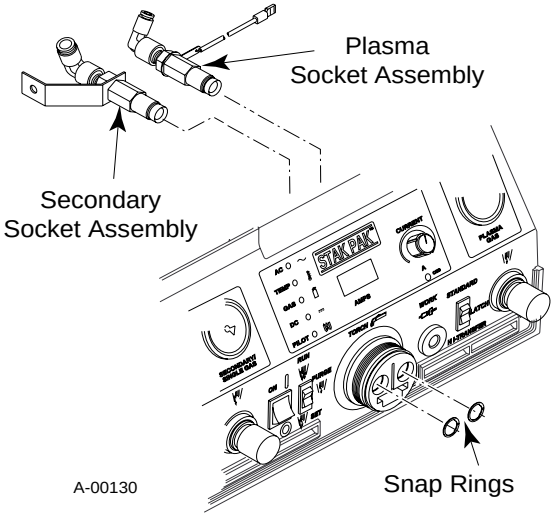


Figure 5-17: Quick Disconnect Socket Assemblies

T. Quick Disconnect Body Replacement

1. Open the Control Module as described in paragraph “A” above.

2. Remove the Secondary and Plasma Gas Quick Disconnect Socket Assemblies per paragraph "S" above.

3. Remove the two white pins holding the electrical connector into the Quick Disconnect Body Assembly.

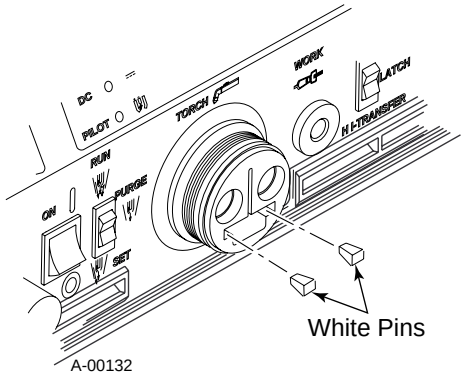


Figure 5-18: Pin Removal

4. Carefully press the tabs down on the electrical connector and remove the connector out the back of the Quick Disconnect Body.

3. Carefully lift the right side of the Front Panel from the base.

NOTE

The Front Panel must be pulled up on the right side to allow access to the snap ring on the Quick Disconnect Body.

5. Remove the snap ring on the Quick Disconnect Body.

6. Slide the connector body out the front of the Front Panel Assembly.

7. Reinstall the replacement Quick Disconnect Body Assembly by reversing the above procedure.

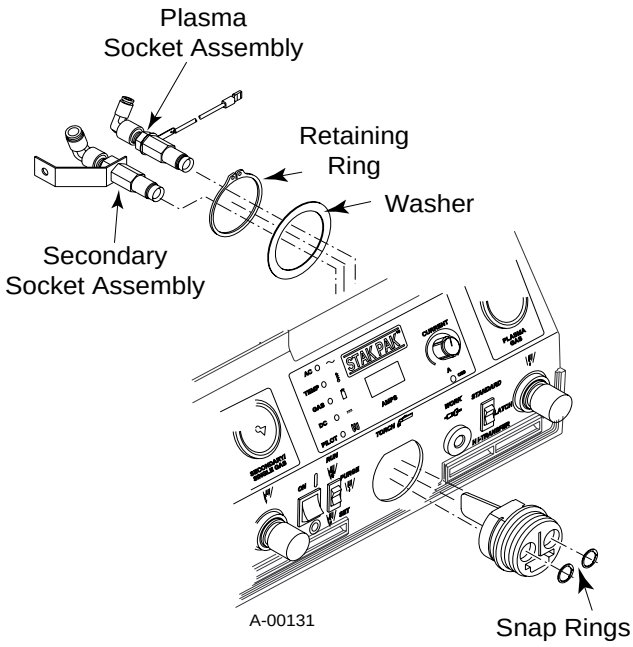


Figure 5-19: Quick Disconnect Body

SECTION 6: PARTS LISTS

6.01 Introduction

A. Parts List Breakdown

The parts list provides a breakdown of all replaceable components. Control modules are field serviceable, so a complete breakdown of parts is provided. Power modules must be returned to an authorized Thermal Arc distributor for service. The parts lists are arranged as follows:

Section 6.03: Control Module Front Panel Assembly

Section 6.04: Control Module Main Assembly

Section 6.05: Control Module Rear Panel Assembly

NOTE

Parts listed without item numbers are not illustrated, but may be ordered by the catalog numbers shown.

B. Returns

If a Thermal Dynamics product must be returned for service, contact your Thermal Dynamics distributor. Materials returned to Thermal Dynamics without proper authorization will not be accepted.

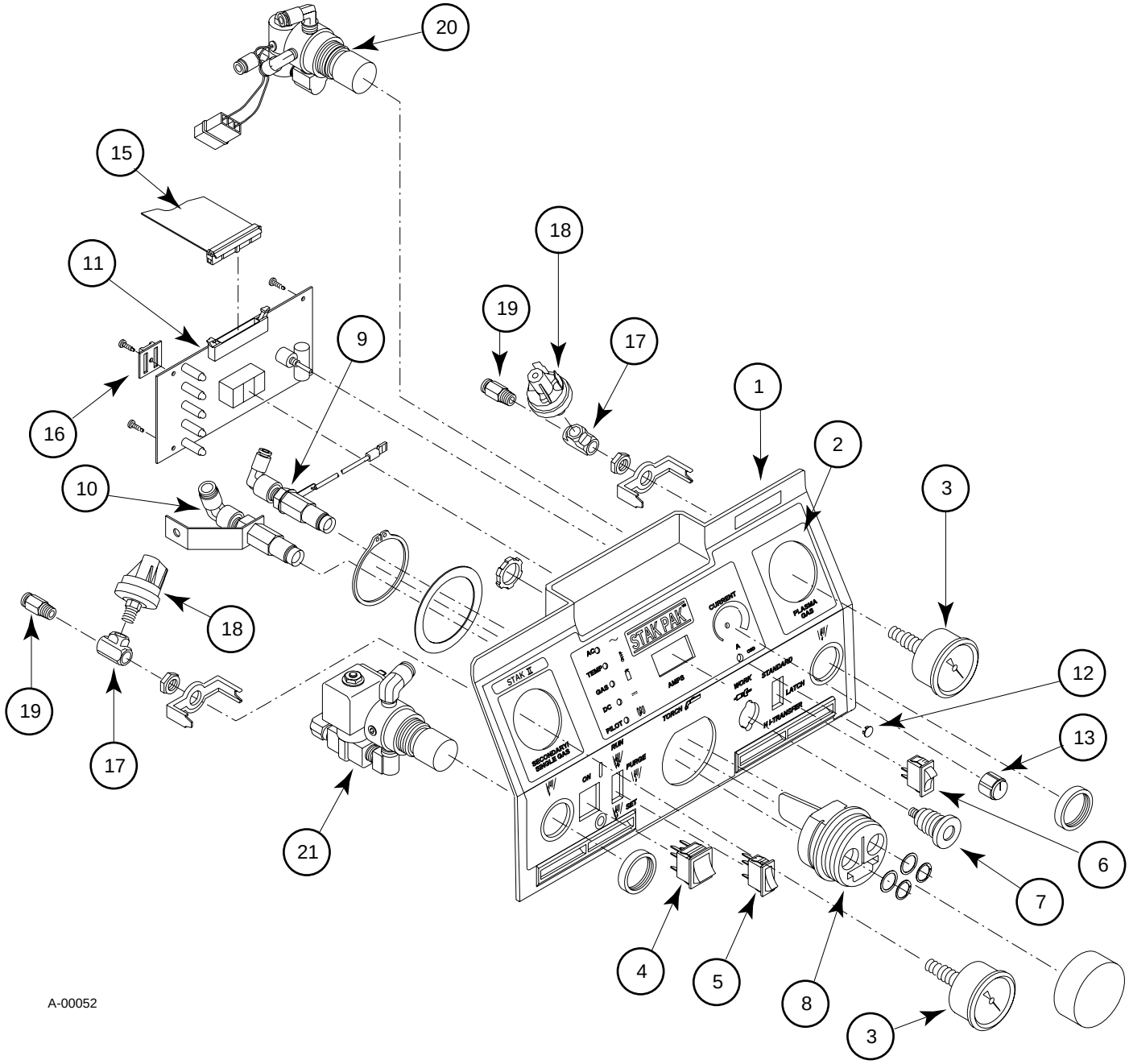
6.02 Ordering Information

Order replacement parts by catalog number and complete description of the part or assembly, as listed in the description column of the Parts List. Also include the model and serial number of the machine as shown on the plate attached to the front panel of the unit. Address all inquiries to your authorized Thermal Dynamics distributor.

6.03 Control Module Front Panel Assembly

Item No.	Qty.	Catalog Number	Description
1	1	8-4315	Front Panel
2	1	8-3372	Front Panel Overlay
3	2	8-4313	Pressure Gauge - 0-100 psi / bar
4	1	8-3258	ON / OFF Switch - DPST
5	1	8-3259	RUN / SET / PURGE Switch - SPDT
6	1	8-3259	STANDARD / LATCH / HI-TRANSFER Switch - SPDT
7	1	8-4316	Work Lead Connector - Female
8	1	9-5834	Quick Disconnect Body Replacement Kit includes: Body, Quick Disconnect, Console, 2 PI Washer, Q.D. Body Wave Spring Clip, Q.D. Body Retaining Ring Retaining Ring, Ext., SS, 9 / 16 Shaft (2 each) Bumper, Locking Tab, Signal Connector (2 each)
9	1	8-3373	Quick Disconnect Socket Assembly - Plasma includes: Fitting, Q.D., Console, Female To 9 / 16-18 & 1 / 4 NPT Spring, Canted Coil Nut, 9 / 16-18 W / 3 / 4 Flats Fitting, 1 / 4 NPT FEM X 1 / 4 Tube 90° Wire Assembly, Pilot Return #48
10	1	8-6332	Quick Disconnect Socket Assembly - Secondary includes: Spring, Canted Coil Bracket, Q.D. / H.F. Coil Nut, 9 / 16-18 W / 3 / 4 Flats Fitting, 1 / 4 NPT FEM X 3 / 8 Tube 90° Fitting, Q.D., Console, Female To 9 / 16-18 & 1 / 4 NPT
11	1	8-6337	Display PC Board
12	4	8-7071	Hole Plug - 1 / 4 in diameter
13	1	9-4146	Current Control Knob
15	1	8-6243	Display Ribbon Cable
16	1	8-6219	Cable Clamp
17	2	8-0312	Female Tee Fitting - 1 / 8 NPT
18	2	9-1044	Pressure Switch - 35 psi
19	2	8-3360	Adaptor - 1 / 8 NPT to 1 / 4 Tube
20	1	8-4333	Regulator / Solenoid Assembly - Plasma
21	1	8-4334	Regulator / Solenoid Assembly - Secondary

Exploded View Of Control Module Front Panel



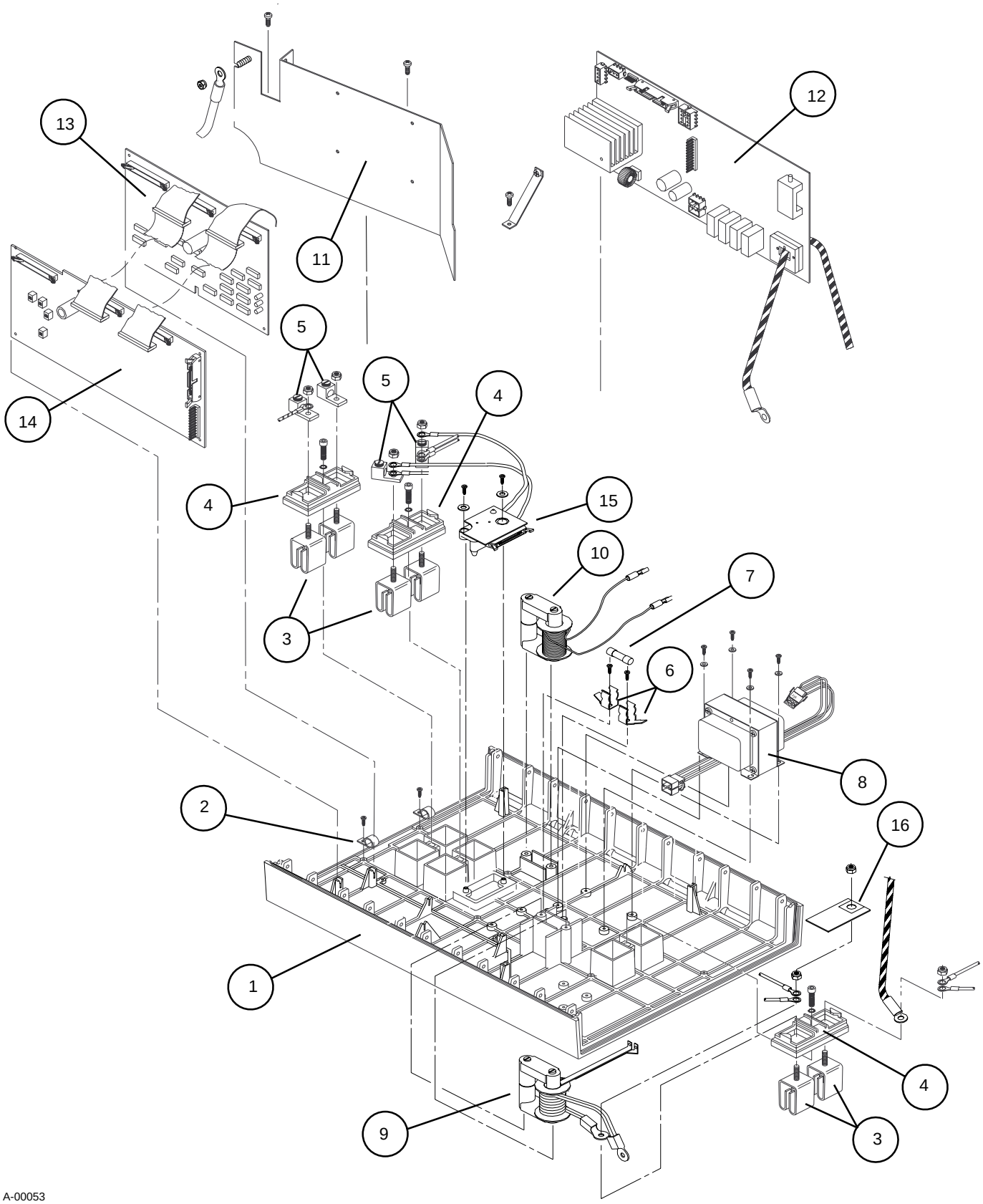
6.04 Control Module Main Assembly

Item No.	Qty.	Catalog Number	Description
1	1	8-6247	Lower Enclosure
2	2	8-6212	Wire Harness Clip - 1/2 in ID
3	6	8-2188	Female Blade Connector
4	3	8-2189	Blade Connector Cover
5	4	8-2190	Input Power Connector (Power Lugs)
6	2	8-6220	Fuse Clip
7	1	9-3861	Fuse - 2 amp, 600V
8	1	8-3335	Auxiliary Transformer Assembly
9	1	8-6238	Transformer Assembly Capacitive Discharge
10	1	8-6239	Pilot Inductor Assembly
11	1	8-6240	Divider Panel Assembly
12	1	8-6237	Pilot PC Board Assembly
13	1	8-6232	Analog PC Board Assembly
14	1	8-6233	Logic Control PC Board Assembly
15	1	8-6231	Module Interconnect PC Board Assembly
16	1	8-6241	RF Filter PC Board Assembly

The following parts are not shown:

1	8-6245	Upper Enclosure
1	8-3338	Overlay - Upper Right Side Panel
1	8-3339	Overlay - Upper Left Side Panel
2	8-3340	Overlay - Lower Side Panel
1	8-6244	Label - Personal Warning
1	8-6223	Label - Pin Installation
1	8-3343	Label - Voltage Warning
1	8-3344	Label - Lifting
1	8-6242	Inductor, Torch Signal

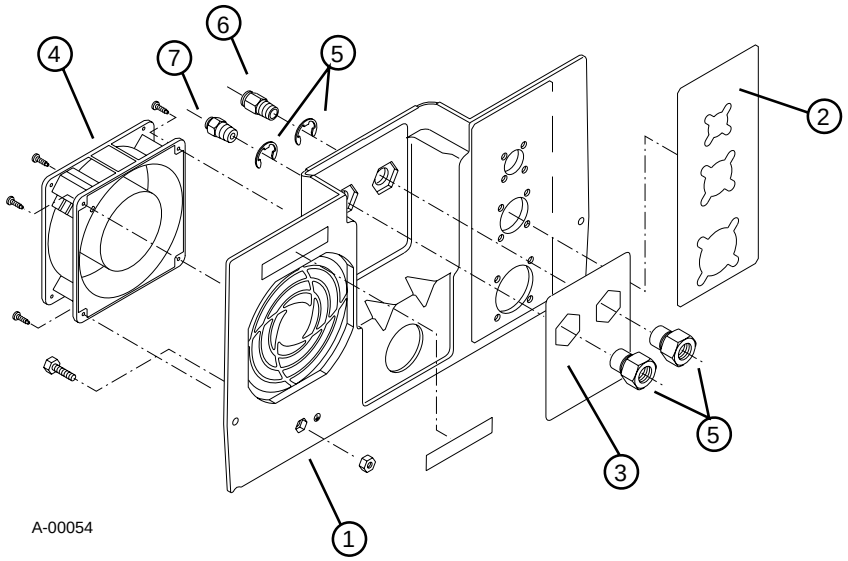
Exploded View Of Control Module Main Assembly



A-00053

6.05 Control Module Rear Panel Assembly

Item No.	Qty.	Catalog Number	Description
1	1	8-4319	Rear Panel - Without Overlays
2	1	8-6235	Rear Panel Overlay - Auxiliary Connections
3	1	8-4321	Rear Panel Overlay - Gases
4	1	8-3209	Fan Assembly
5	2	9-6232	Adaptor Fitting - Inert B to 1/4 NPT Female, with Ring Groove
6	1	8-6236	Plasma Adaptor Fitting - 1/4 NPT to 1/4 Tube
7	1	9-6230	Secondary/Single-Gas Adaptor Fitting - 1/4 NPT to 3/8 Tube



APPENDIX I: REMOTE PCB (CNC INTERFACE) CONNECTIONS

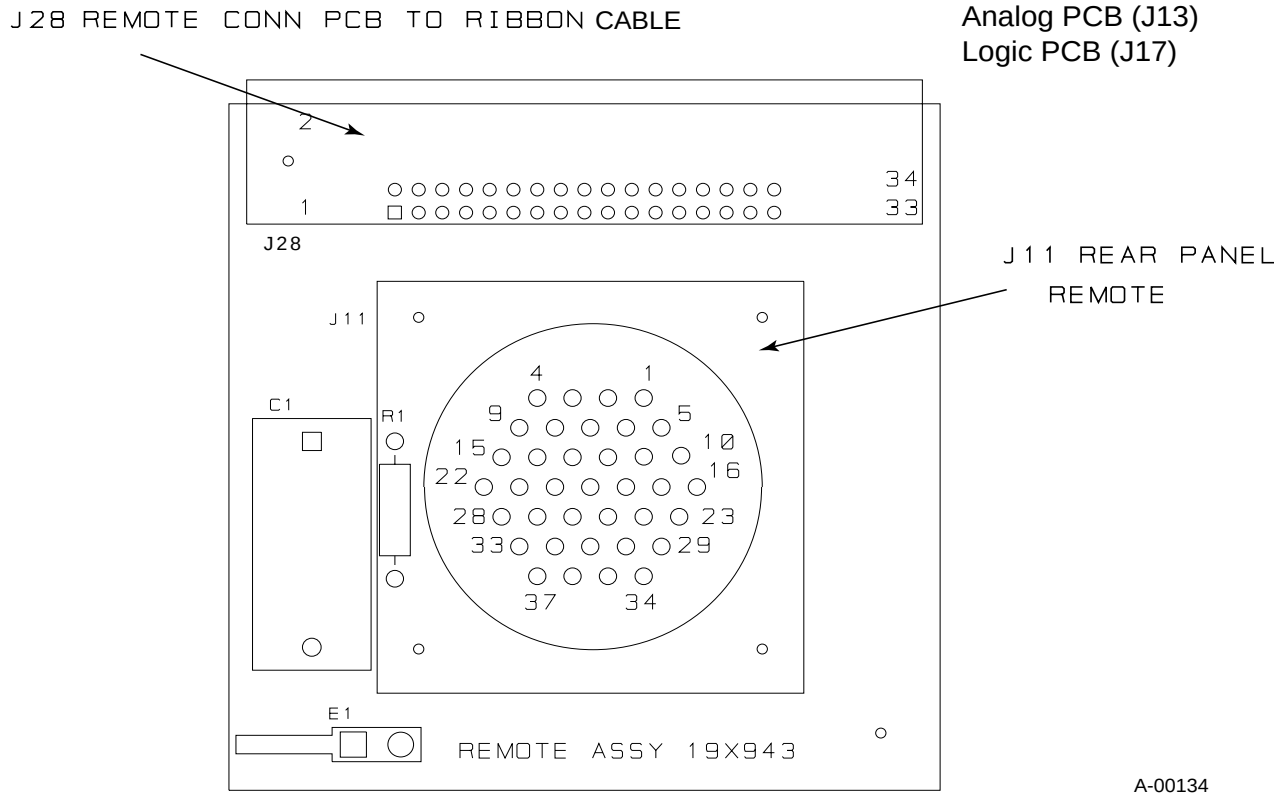
J11 to Remote Ribbon Cable J28

PIN #	SIG.	FROM-TO*
1	RUN/$\overline{\text{PURGE}}$	R-L
3	$\overline{\text{HI}}$/LOW SPEED	R-L
5	$\overline{\text{START}}$/STOP	R-L
7	POT LOW	A-R
9	DEMAND	R-A
13	$\overline{\text{START LED}}$	L-R
17	AMP DISPLAY	A-R
19	POT HIGH	A-R
21	36VAC ct	L-R
23	S6CACa	L-R
25	36VACb	L-R
27	$\overline{\text{REMOTE INSTALLED}}$	R-L, A
31	$\overline{\text{CSD}}$	R-A
33	E-STOP	R-L

FROM-TO
R=REMOTE
L=LOGIC
A=ANALOG

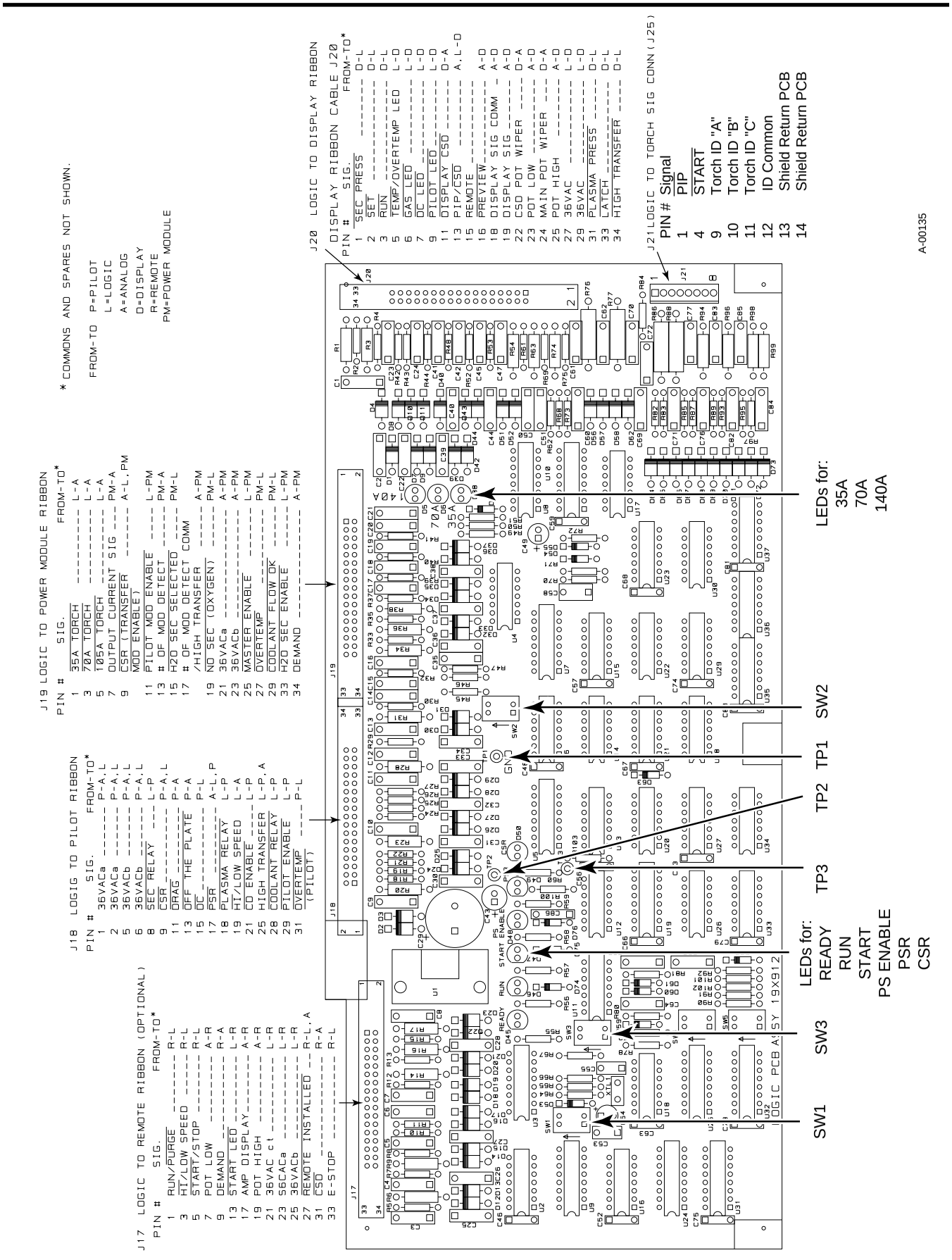
* COMMONS AND SPARES NOT SHOWN.

Remote Ribbon Cable J28 to:
Analog PCB (J13)
Logic PCB (J17)

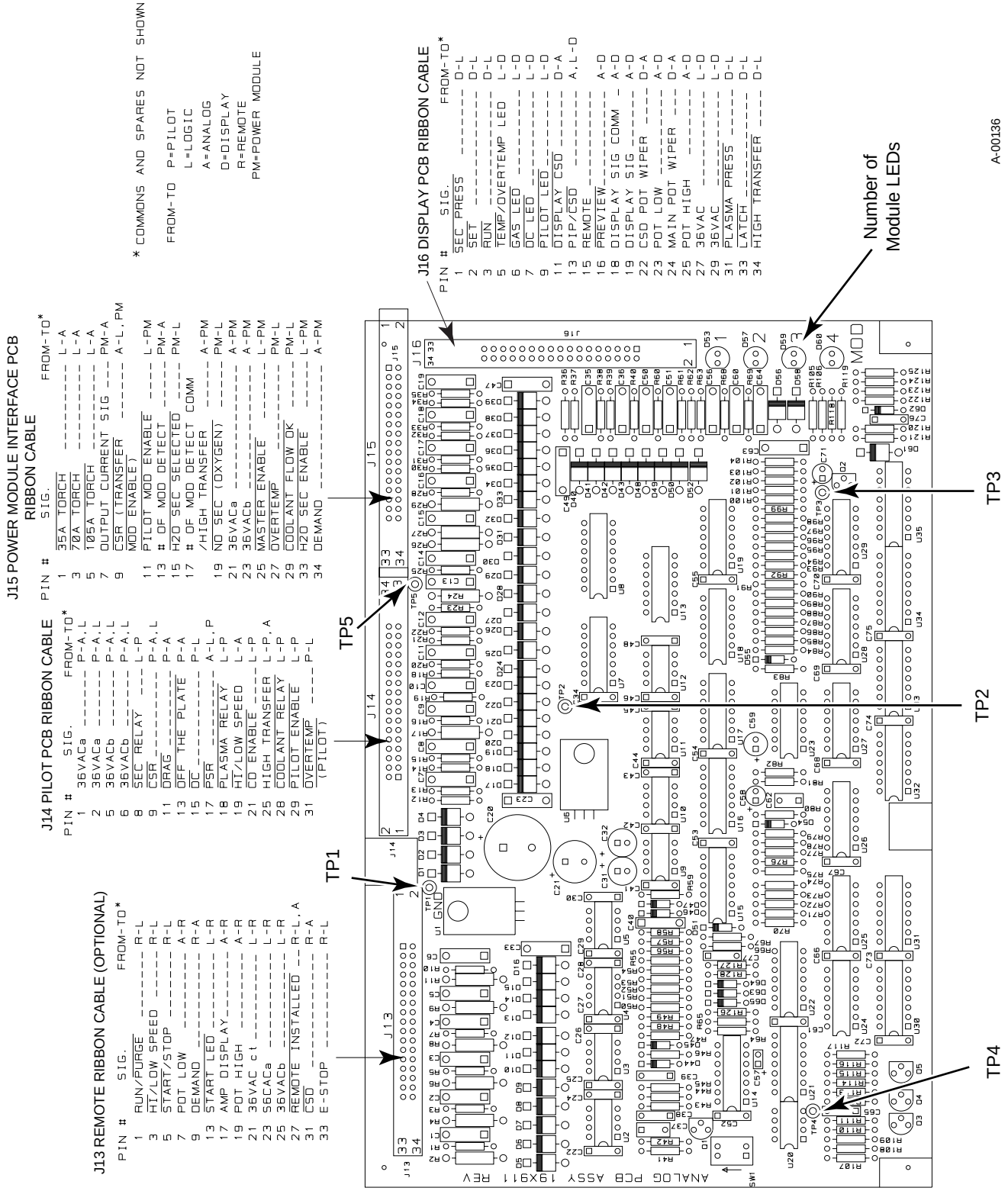


A-00134

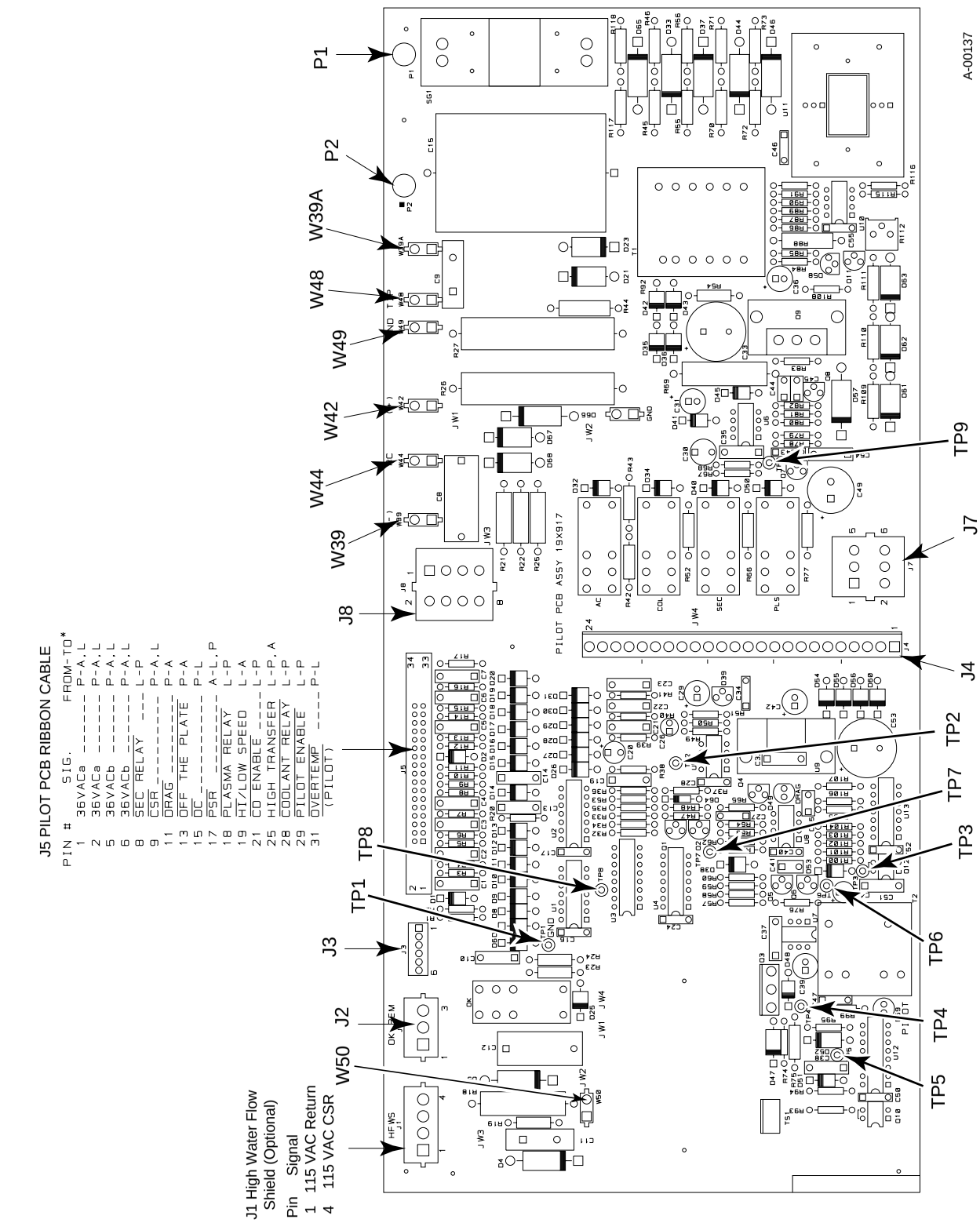
APPENDIX II: LOGIC PCB CONNECTIONS


J19 LOGIC TO POWER MODULE RIBBON
PIN # SIG. FROM-TO*
1 35A TORCH L-A
3 70A TORCH L-A
5 105A TORCH L-A
7 OUTPUT CURRENT SIG PM-A
9 CSR (TRANSFER MOD ENABLE) A-L,PM
11 PILOT MOD ENABLE L-PM
13 # OF MOD DETECT PM-A
15 H2O SEC SELECTED PM-L
17 # OF MOD DETECT COMM /HIGH TRANSFER A-PM
19 NO SEC (OXYGEN) PM-L
21 36VACa A-PM
23 36VACb A-PM
25 MASTER ENABLE L-PM
27 OVERTEMP PM-L
29 COOLANT FLOW OK PM-L
33 H2O SEC ENABLE L-PM
34 DEMAND A-PM
* COMMONS AND SPARES NOT SHOWN.
FROM-TO P=PILOT L=LOGIC A=ANALOG D=DISPLAY R=REMOTE PM=POWER MODULE
J20 LOGIC TO DISPLAY RIBBON
DISPLAY RIBBON CABLE J20
PIN # SIG. FROM-TO*
1 SEC PRESS D-L
2 SET D-L
3 RUN D-L
5 TEMP/OVERTEMP LED L-D
6 GAS LED L-D
7 DC LED L-D
9 PILOT LED L-D
11 DISPLAY CSD D-A
13 PIP/CSD A,L-D
15 REMOTE
16 PREVIEW A-D
18 DISPLAY SIG COMM A-D
19 DISPLAY SIG A-D
22 CSD POT WIPER D-A
23 POT LOW D-A
24 MAIN POT WIPER D-A
25 POT HIGH A-D
27 36VAC L-D
29 36VAC D-L
31 PLASMA PRESS D-L
33 LATCH D-L
34 HIGH TRANSFER D-L
J18 LOGIG TO PILOT RIBBON
PIN # SIG. FROM-TO*
1 36VACa P-A,L
2 36VACa P-A,L
5 36VACb P-A,L
6 36VACb P-A,L
8 SEC RELAY L-P
9 CSR P-A,L
11 DRAG P-A
13 OFF THE PLATE P-A
15 DC P-L
17 PSR A-L,P
18 PLASMA RELAY L-P
19 HI/LOW SPEED L-A
21 CD ENABLE L-P
25 HIGH TRANSFER L-P,A
28 COOLANT RELAY L-P
29 PILOT ENABLE L-P
31 OVERTEMP (PILOT) P-L
J17 LOGIC TO REMOTE RIBBON (OPTIONAL)
PIN # SIG. FROM-TO*
1 RUN/PURGE R-L
3 HI/LOW SPEED R-L
5 START/STOP R-L
7 POT LOW A-R
9 DEMAND R-A
13 START LED L-R
17 AMP DISPLAY A-R
19 POT HIGH A-R
21 36VAC ct L-R
23 56CACa L-R
25 36VACb R-L,A
27 REMOTE INSTALLED R-L
31 CSD R-A
33 E-STOP R-L
J21LOGIC TO TORCH SIG CONN(J25)
PIN # Signal
1 PIP
4 START
9 Torch ID "A"
10 Torch ID "B"
11 Torch ID "C"
12 ID Common
13 Shield Return PCB
14 Shield Return PCB
LEDs for: 35A 70A 140A
LEDs for: READY RUN START PS ENABLE PSR CSR
SW1 SW3 TP3 TP2 TP1 SW2
A-00135

APPENDIX III: ANALOG PCB CONNECTIONS


J15 POWER MODULE INTERFACE PCB RIBBON CABLE
PIN # SIG. FROM-TO*
1 35A TORCH ---------- L-A
3 70A TORCH ---------- L-A
5 105A TORCH ---------- L-A
7 OUTPUT CURRENT SIG --- PM-A
9 CSR (TRANSFER MOD ENABLE) ------ A-L,PM
11 PILOT MOD ENABLE ---- L-PM
13 # OF MOD DETECT ----- PM-A
15 H2O SEC SELECTED ---- PM-L
17 # OF MOD DETECT COMM /HIGH TRANSFER ----- A-PM
19 NO SEC (OXYGEN) ----- PM-L
21 36VACa ---------- A-PM
23 36VACb ---------- L-PM
25 MASTER ENABLE ------- PM-L
27 OVERTEMP ---------- PM-L
29 COOLANT FLOW OK ----- PM-L
33 H2O SEC ENABLE ------ L-PM
34 DEMAND ---------- A-PM
* COMMONS AND SPARES NOT SHOWN.
FROM-TO P=PILOT
L=LOGIC
A=ANALOG
D=DISPLAY
R=REMOTE
PM=POWER MODULE
J14 PILOT PCB RIBBON CABLE
PIN # SIG. FROM-TO*
1 36VACa ------ P-A,L
2 36VACa ------ P-A,L
5 36VACb ------ P-A,L
6 36VACb ------ P-A,L
8 SEC RELAY --- L-P
9 CSR ---------- P-A,L
11 DRAG --------- P-A
13 OFF THE PLATE P-A
15 DC ---------- P-L
17 PSR --------- A-L,P
18 PLASMA RELAY L-P
19 HI/LOW SPEED L-A
21 CO ENABLE ---- L-P
25 HIGH TRANSFER L-P,A
28 COOLANT RELAY L-P
29 PILOT ENABLE L-P
31 OVERTEMP ---- P-L
(PILOT)
J13 REMOTE RIBBON CABLE (OPTIONAL)
PIN # SIG. FROM-TO*
1 RUN/PURGE ------- R-L
3 HI/LOW SPEED ----- R-L
5 START/STOP ------ R-L
7 POT LOW -------- A-R
9 DEMAND --------- R-A
13 START LED ------- L-R
17 AMP DISPLAY----- A-R
19 POT HIGH ------- A-R
21 36VAC ct ------- L-R
23 56CACa --------- L-R
25 36VACb --------- L-R
27 REMOTE INSTALLED -- R-L,A
31 CSD ------------ R-A
33 E-STOP --------- R-L
J16 DISPLAY PCB RIBBON CABLE
PIN # SIG. FROM-TO*
1 SEC PRESS ------- D-L
2 SET ------------ D-L
3 RUN ------------ D-L
5 TEMP/OVERTEMP LED L-D
6 GAS LED -------- L-D
7 DC LED --------- L-D
9 PILOT LED ------ L-D
11 DISPLAY CSD ---- D-A
13 PIP/CSD ------- A,L-D
15 REMOTE -------- A-D
16 PREVIEW------- A-D
18 DISPLAY SIG COMM - A-D
19 DISPLAY SIG ---- A-D
22 CSD POT WIPER -- D-A
23 POT LOW ------- A-D
24 MAIN POT WIPER -- D-A
25 POT HIGH ------ A-D
27 36VAC -------- L-D
29 36VAC -------- L-D
31 PLASMA PRESS --- D-L
33 LATCH --------- D-L
34 HIGH TRANSFER -- D-L
TP1
TP2
TP3
TP4
TP5
Number of Module LEDs
A-00136

APPENDIX IV: PILOT PCB CONNECTIONS



APPENDIX V: DISPLAY PCB CONNECTIONS

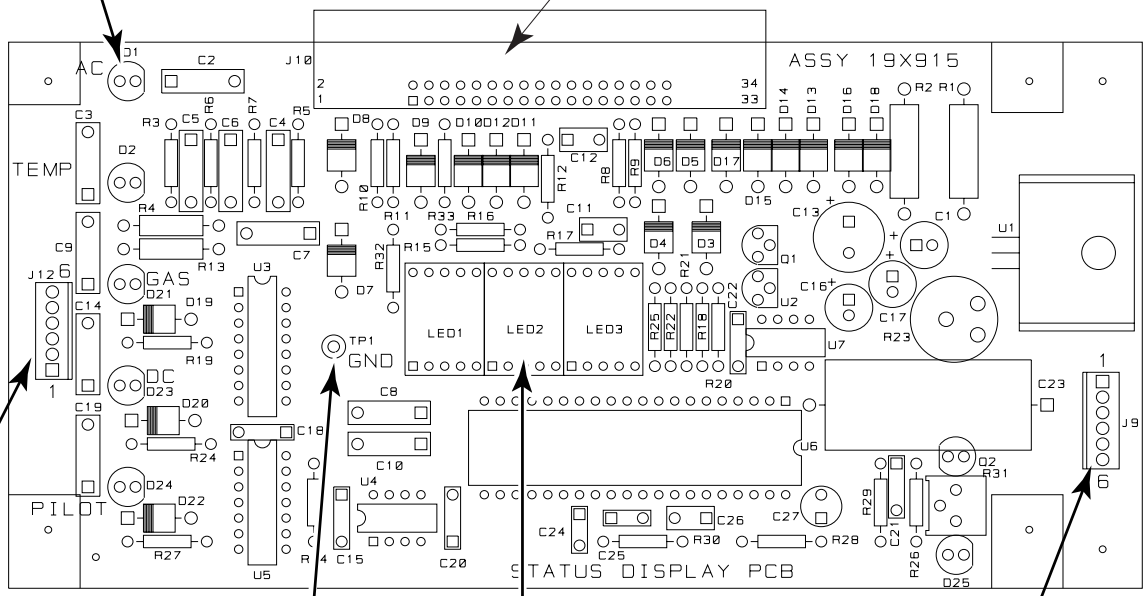
J10 DISPLAY PCB RIBBON CABLE

PIN #	SIG.	FROM-TO*
1	SEC PRESS	D-L
2	SET	D-L
3	RUN	D-L
5	TEMP/OVERTEMP LED	L-D
6	GAS LED	L-D
7	DC LED	L-D
9	PILOT LED	L-D
11	DISPLAY CSD	D-A
13	PIP/CSD	A,L-D
15	REMOTE	
16	PREVIEW	A-D
18	DISPLAY SIG COMM	A-D
19	DISPLAY SIG	A-D
22	CSD POT WIPER	D-A
23	POT LOW	A-D
24	MAIN POT WIPER	D-A
25	POT HIGH	A-D
27	36VAC	L-D
29	36VAC	L-D
31	PLASMA PRESS	D-L
33	LATCH	D-L
34	HIGH TRANSFER	D-L

* COMMONS AND SPARES NOT SHOWN.

FROM-TO P=PILOT
L=LOGIC
A=ANALOG
D=DISPLAY
R=REMOTE
PM=POWER MODULE

Front Panel LEDs:
AC
TEMP
GAS
DC
PILOT



J12 PS2 & RUN/PURGE/SET Switch

Pin #	Signal
1	RUN Side of RUN/PURGE/SET Switch
2	Center of RUN/PURGE/SET Switch
3	SET Side of RUN/PURGE/SET Switch
5	One Side of Secondary Pressure Switch PS2
6	Normally Open Side of Secondary Pressure Switch PS2

TP1

Display Modules

J9 PS1 & STANDARD/LATCH/HI-TRANSFER Switch

Pin #	Signal
1	STANDARD Side of STANDARD/LATCH/HI-TRANSFER Switch
2	Center of STANDARD/LATCH/HI-TRANSFER Switch
3	HI-TRANSFER Side of STANDARD/LATCH/HI-TRANSFER Switch
5	One Side of Plasma Pressure Switch PS1
6	Normally Open Side of Plasma Pressure Switch PS1

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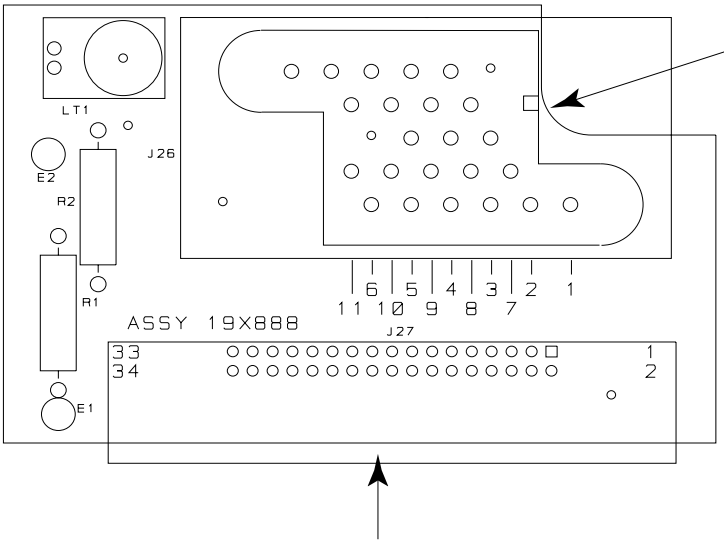
APPENDIX VI: POWER MODULE INTERFACE PCB CONNECTIONS



J26 Power Supply Connector

Pin #	Signal
1	# MOD DET
2	# MOD DET COM
3	NO SEC (OXYGEN)
4	TO COMMON
5	OVERTEMP
6	TO COMMON
7	H2O SEC
8	36 VACa
9	36 VACb
10	COOLANT FLOW OK
11	TO COMMON
12	PILOT MOD ENABLE
13	TO COMMON
14	PM ENABLE
15	COOLANT ENABLE
16	36 VACct
17	TRANSFER MOD ENABLE
19	TO COMMON
20	115 VAC RET
21	OUTPUT CURRENT SIG
22	TO COMMON
23	TO COMMON
24	DEMAND
25	H2O SEC ENABLE

J27 POWER MODULE INTERFACE PCB RIBBON CABLE

PIN #	SIG.	FROM-TO*
1	35A TORCH	L-A
3	70A TORCH	L-A
5	105A TORCH	L-A
7	OUTPUT CURRENT SIG	PM-A
9	CSR (TRANSFER MOD ENABLE)	A-L,PM
11	PILOT MOD ENABLE	L-PM
13	# OF MOD DETECT	PM-A
15	H2O SEC SELECTED	PM-L
17	# OF MOD DETECT COMM /HIGH TRANSFER	A-PM
19	NO SEC (OXYGEN)	PM-L
21	36VACa	A-PM
23	36VACb	A-PM
25	MASTER ENABLE	L-PM
27	OVERTEMP	PM-L
29	COOLANT FLOW OK	PM-L
33	H2O SEC ENABLE	L-PM
34	DEMAND	A-PM

* COMMONS AND SPARES NOT SHOWN.

FROM-TO P=PILOT
L=LOGIC
A=ANALOG
D=DISPLAY
R=REMOTE
PM=POWER MODULE

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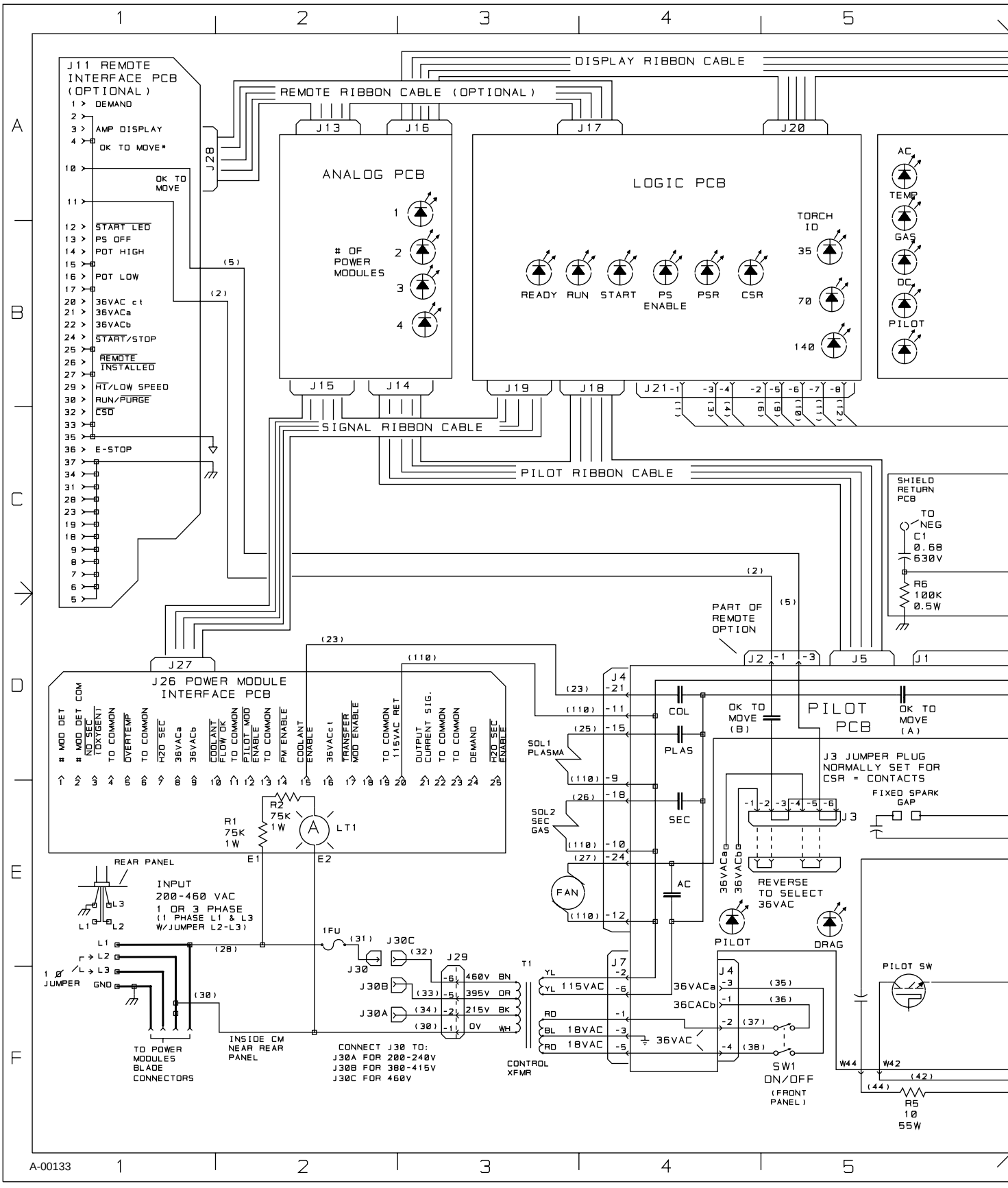
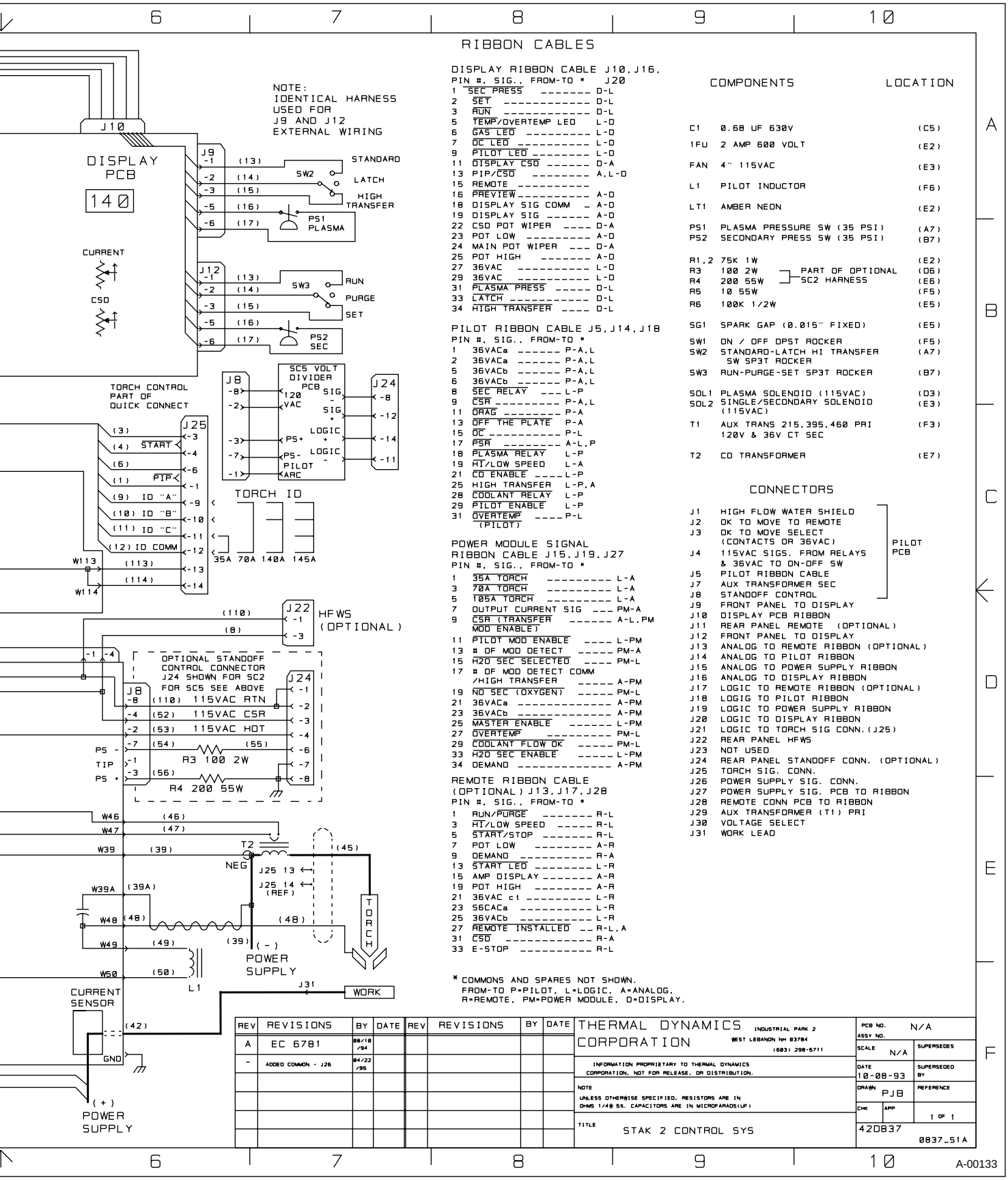
APPENDIX VII: INPUT WIRING REQUIREMENTS

Input		Power	Power Input		Current		Recommended Sizes					
Voltage	Freq.	Mod's	1-Ph	3-Ph	1-Ph	3-Ph	Fuse (Amps)		Wire (AWG)		Wire (Canada)	
(Volts)	(Hz)	(Qty)	(kVA)	(kVA)	(Amps)	(Amps)	1-Ph	3-Ph	1-Ph	3-Ph	1-Ph	3-Ph
180	50/60	1	8	7	43	23	50	30	10	12	6	10
		2	17	16	94	51	100	50	4	8	2	6
		3	27	26	150	82	150	90	1/0	4	2/0	2
		4	41	39	225	125	225	125	3/0	2	4/0	1/0
200	50/60	1	8	7	39	21	45	25	10	12	8	10
		2	17	16	84	46	90	50	4	8	3	6
		3	27	26	136	74	150	80	1/0	4	2/0	2
		4	41	39	207	112	225	125	3/0	2	4/0	1/0
220	50/60	1	8	7	35	19	40	25	10	12	8	10
		2	17	16	77	41	90	50	4	8	3	6
		3	27	26	124	67	150	70	1/0	6	2/0	4
		4	41	39	189	102	200	110	3/0	2	4/0	2
240	50/60	1	8	7	32	18	35	25	12	12	8	10
		2	17	16	70	38	80	45	4	8	3	6
		3	27	26	113	61	125	70	2	6	2/0	4
		4	41	39	173	94	200	100	3/0	2	4/0	2
380	50/60	1	8	7	20	11	25	15	14	16	10	12
		2	17	16	44	24	50	30	10	12	6	10
		3	27	26	72	39	80	45	4	8	3	6
		4	41	39	109	59	125	70	2	6	2/0	4
460	50/60	1	8	7	17	9	25	15	14	16	10	12
		2	17	16	37	20	45	25	10	12	8	10
		3	27	26	59	32	70	40	6	10	4	6
		4	41	39	90	49	100	60	4	6	2	4
506	50/60	1	8	7	15	8	20	12	16	18	10	12
		2	17	16	33	18	40	25	10	12	8	10
		3	27	26	54	29	70	35	6	10	4	8
		4	41	39	82	44	90	50	4	8	3	6
575	Requires Transformer Module											

Line Voltages with Recommended Circuit Protection and Wire Sizes
(Based on Table 310-16, 1987 National Electric Code) and Table 4, Canadian Electrical Code.

APPENDIX VIII: SYSTEM SCHEMATIC




RIBBON CABLES
NOTE:
IDENTICAL HARNESS
USED FOR
J9 AND J12
EXTERNAL WIRING
J10
DISPLAY
PCB
140
J9
J12
STANDARD
LATCH
HIGH
TRANSFER
SW2
PS1
PLASMA
RUN
PURGE
SET
SW3
PS2
SEC
CURRENT
CSD
TORCH CONTROL
PART OF
QUICK CONNECT
J25
START
PIP
ID "A"
ID "B"
ID "C"
ID COMM
W113
W114
J8
J24
SC5 VOLT
DIVIDER
PCB
120
VAC
SIG
LOGIC
PS+
PS-
PILOT
ARC
TORCH ID
35A 70A 140A 145A
J22
HFWS
(OPTIONAL)
OPTIONAL STANDOFF
CONTROL CONNECTOR
J24 SHOWN FOR SC2
FOR SC5 SEE ABOVE
115VAC RTN
115VAC CSR
115VAC HOT
PS -
TIP
PS +
R3 100 2W
R4 200 55W
W46
W47
W39
W39A
W48
W49
W50
T2
NEG
J25 13
J25 14
(REF)
TORCH
POWER
SUPPLY
L1
CURRENT
SENSOR
GND
POWER
SUPPLY
J31
WORK
DISPLAY RIBBON CABLE J10,J16,
PIN #, SIG., FROM-TO * J20
1 SEC PRESS -------- D-L
2 SET ------------ D-L
3 RUN ------------ D-L
5 TEMP/OVERTEMP LED L-D
6 GAS LED -------- L-D
7 OC LED --------- L-D
9 PILOT LED ------- L-D
11 DISPLAY CSD ------ D-A
13 PIP/CSD -------- A,L-D
15 REMOTE ---------
16 PREVIEW -------- A-D
18 DISPLAY SIG COMM - A-D
19 DISPLAY SIG ------ A-D
22 CSD POT WIPER ---- D-A
23 POT LOW -------- A-D
24 MAIN POT WIPER --- D-A
25 POT HIGH ------- A-D
27 36VAC ---------- L-D
29 36VAC ---------- L-D
31 PLASMA PRESS ----- D-L
33 LATCH ---------- D-L
34 HIGH TRANSFER ---- D-L
PILOT RIBBON CABLE J5,J14,J18
PIN #, SIG., FROM-TO *
1 36VACa ------ P-A,L
2 36VACa ------ P-A,L
5 36VACb ------ P-A,L
6 36VACb ------ P-A,L
8 SEC RELAY --- L-P
9 CSR -------- P-A,L
11 DRAG ------- P-A
13 OFF THE PLATE P-A
15 OC --------- P-L
17 PSR -------- A-L,P
18 PLASMA RELAY L-P
19 HT/LOW SPEED L-A
21 CO ENABLE ---- L-P
25 HIGH TRANSFER L-P,A
28 COOLANT RELAY L-P
29 PILOT ENABLE L-P
31 OVERTEMP ---- P-L
(PILOT)
POWER MODULE SIGNAL
RIBBON CABLE J15,J19,J27
PIN #, SIG., FROM-TO *
1 35A TORCH --------- L-A
3 70A TORCH --------- L-A
5 105A TORCH -------- L-A
7 OUTPUT CURRENT SIG --- PM-A
9 CSR (TRANSFER ------ A-L,PM
MOD ENABLE)
11 PILOT MOD ENABLE ---- L-PM
13 # OF MOD DETECT ----- PM-A
15 H2O SEC SELECTED ---- PM-L
17 # OF MOD DETECT COMM
/HIGH TRANSFER ----- A-PM
19 NO SEC (OXYGEN) ----- PM-L
21 36VACa ---------- A-PM
23 36VACb ---------- A-PM
25 MASTER ENABLE ------ L-PM
27 OVERTEMP --------- PM-L
29 COOLANT FLOW OK ---- PM-L
33 H2O SEC ENABLE ---- L-PM
34 DEMAND ---------- A-PM
REMOTE RIBBON CABLE
(OPTIONAL) J13,J17,J28
PIN #, SIG., FROM-TO *
1 RUN/PURGE -------- R-L
3 HT/LOW SPEED ----- R-L
5 START/STOP ------- R-L
7 POT LOW --------- A-R
9 DEMAND ---------- R-A
13 START LED -------- L-R
15 AMP DISPLAY ------ A-R
19 POT HIGH -------- A-R
21 36VAC ct -------- L-R
23 S6CACa ---------- L-R
25 36VACb ---------- L-R
27 REMOTE INSTALLED -- R-L,A
31 CSD ------------ R-A
33 E-STOP ---------- R-L
* COMMONS AND SPARES NOT SHOWN.
FROM-TO P=PILOT, L=LOGIC, A=ANALOG,
R=REMOTE, PM=POWER MODULE, D=DISPLAY.
COMPONENTS LOCATION
C1 0.68 UF 630V (C5)
1FU 2 AMP 600 VOLT (E2)
FAN 4" 115VAC (E3)
L1 PILOT INDUCTOR (F6)
LT1 AMBER NEON (E2)
PS1 PLASMA PRESSURE SW (35 PSI) (A7)
PS2 SECONDARY PRESS SW (35 PSI) (B7)
R1,2 75K 1W (E2)
R3 100 2W (D6)
R4 200 55W PART OF OPTIONAL SC2 HARNESS (E6)
R5 10 55W (F5)
R6 100K 1/2W (E5)
SG1 SPARK GAP (0.015" FIXED) (E5)
SW1 ON / OFF DPST ROCKER (F5)
SW2 STANDARD-LATCH HI TRANSFER SW SP3T ROCKER (A7)
SW3 RUN-PURGE-SET SP3T ROCKER (B7)
SOL1 PLASMA SOLENOID (115VAC) (D3)
SOL2 SINGLE/SECONDARY SOLENOID (115VAC) (E3)
T1 AUX TRANS 215,395,460 PRI 120V & 36V CT SEC (F3)
T2 CO TRANSFORMER (E7)
CONNECTORS
J1 HIGH FLOW WATER SHIELD
J2 OK TO MOVE TO REMOTE
J3 OK TO MOVE SELECT (CONTACTS OR 36VAC)
J4 115VAC SIGS. FROM RELAYS & 36VAC TO ON-OFF SW
J5 PILOT RIBBON CABLE
J7 AUX TRANSFORMER SEC
J8 STANDOFF CONTROL
PILOT PCB
J9 FRONT PANEL TO DISPLAY
J10 DISPLAY PCB RIBBON
J11 REAR PANEL REMOTE (OPTIONAL)
J12 FRONT PANEL TO DISPLAY
J13 ANALOG TO REMOTE RIBBON (OPTIONAL)
J14 ANALOG TO PILOT RIBBON
J15 ANALOG TO POWER SUPPLY RIBBON
J16 ANALOG TO DISPLAY RIBBON
J17 LOGIC TO REMOTE RIBBON (OPTIONAL)
J18 LOGIG TO PILOT RIBBON
J19 LOGIC TO POWER SUPPLY RIBBON
J20 LOGIC TO DISPLAY RIBBON
J21 LOGIC TO TORCH SIG CONN.(J25)
J22 REAR PANEL HFWS
J23 NOT USED
J24 REAR PANEL STANDOFF CONN. (OPTIONAL)
J25 TORCH SIG. CONN.
J26 POWER SUPPLY SIG. CONN.
J27 POWER SUPPLY SIG. PCB TO RIBBON
J28 REMOTE CONN PCB TO RIBBON
J29 AUX TRANSFORMER (T1) PRI
J30 VOLTAGE SELECT
J31 WORK LEAD
REV REVISIONS BY DATE
A EC 6781 08/10/94
- ADDED COMMON - J26 04/22/95
THERMAL DYNAMICS CORPORATION
INDUSTRIAL PARK 2
WEST LEBANON NH 03784
(603) 298-5711
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NOTE
UNLESS OTHERWISE SPECIFIED, RESISTORS ARE IN OHMS 1/4W 5%. CAPACITORS ARE IN MICROFARADS(UF)
TITLE
STAK 2 CONTROL SYS
PCB NO. N/A
ASSY NO.
SCALE N/A
SUPERSEDES
DATE 10-08-93
SUPERSEDED BY
DRAWN PJB
REFERENCE
CHK APP
1 OF 1
420837
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A-00133